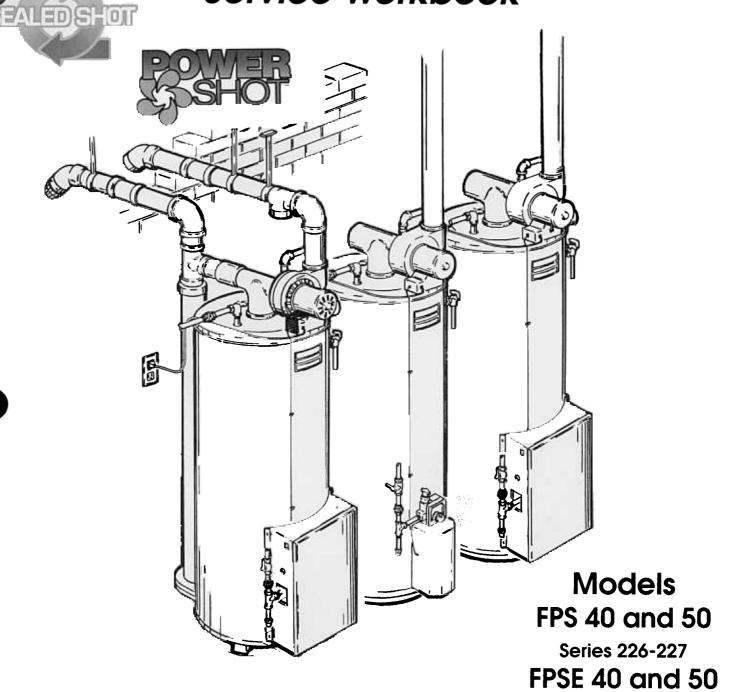
# POWER VENT WATER HEATERS Service Workbook



Prepared by the Technical Information Dept. Irving, Texas



A DIVISION OF A.O. SMITH CORPORATION



Series 226-227 **FPS 75** Series 230-233

Series 226E

FPD 40 and 50

#### WORKBOOK INTRODUCTION

#### **Purpose**

The information contained in this workbook is designed to answer situations commonly encountered in the operation of the POWER SHOT and SEALED SHOT Product and is not meant to be all inclusive. If you are experiencing a problem not covered in this workbook, please contact the A.O. Smith Technical Information Department at (800)527-1953 or your local A.O. Smith Water Products Company representative for further assistance.

This workbook is intended for use by licensed plumbing professionals and reference should be made to the installation manual accompanying the product.

#### Model and Series Nos. Affected

This workbook covers the following models and series numbers. If your model is not listed, see other workbooks.

Model Series Model Series FPS 40 & 50 - 226 & 227 FPSE 40 & 50 - 226E

Model Series Model Series FPD 40 & 50 - 226 & 227 FPS 75 - 230 & 231 FPS 75 - 232 & 233

#### Qualifications

Service of these water heaters must be performed by a qualified service professional. Gas supply, plumbing, air supply, venting and electrical work are required.

# Reproduction of this Workbook

No duplication or reproduction of this book may be made without the express written authorization of A.O. Smith Water Products Company.

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#### CHOOSING THE BEST WATER HEATER

Introduction:

FPSE FPD The A.O. Smith power vent family of residential water heaters is designed to meet different installation conditions. Therefore we must evaluate the job site in which these heaters are to be installed.



When to choose the: FPS40 - 50

The FPS40 - 50, Power Shot, is the best choice for those installations that need sidewall venting or complex vertical venting. It can be installed in an alcove, closet, or anywhere a source of fresh make-up air is available. Makeup air provides air for combustion and dilution air for venting. The FPS40 - 50 feature a standing pilot.

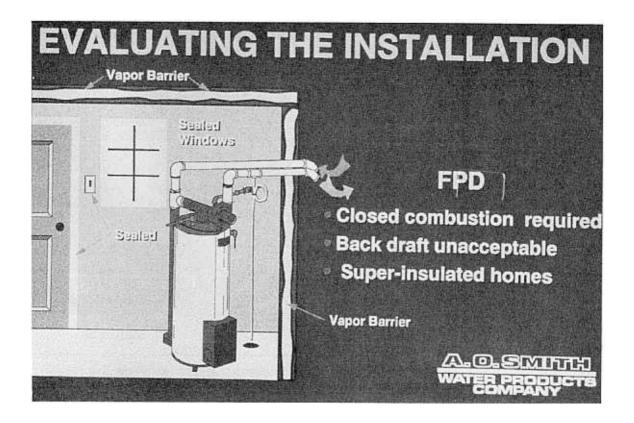
#### CHOOSING THE BEST WATER HEATER cont.



When to choose the: FPSE FPS75

Here the FPSE40 - 50 or FPS75, Power Shot, is the best choice for an installation where a negative pressure condition could develop from other appliance exhaust fans installed in the house. This illustration shows the heater in a large open basement. Air for combustion is drawn from inside the building, make up air is required. The FPSE and FPS75 use electronic spark ignition.

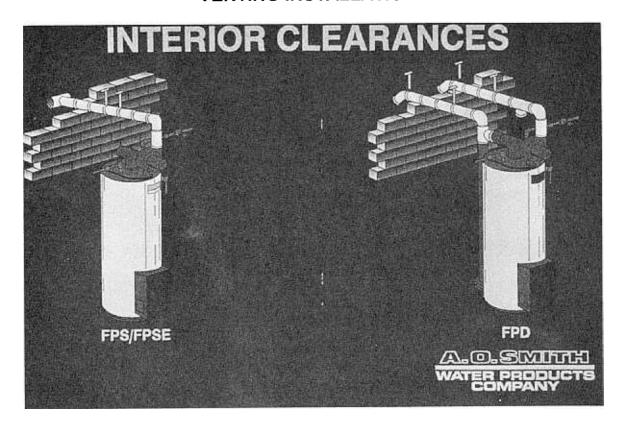
#### CHOOSING THE BEST WATER HEATER cont.



When to choose the: FPD

The FPD Sealed Shot with its own dedicated air vent and exhaust vent, is the heater of choice in installations where closed combustion is required - for example in living quarters. The FPD is recommended when installing a water heater in a super insulated energy efficient house, with sealed gaskets around the windows and doors.

#### **VENTING INSTALLATION**



Interior Clearances: FPS

FPSE FPD All interior clearance requirements indicate distances between the heater and combustible materials.

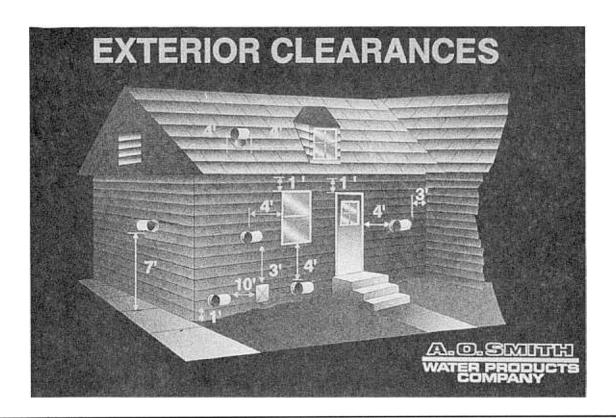
Clearance of 0" is allowed from PVC vent to combustibles.

Clearances allowed for the FPS40 - 50, FPSE40 - 50, and FPD40 - 50 are:

Sides and rear - 0" Front - 4" Top - 21"

Clearances allowed for the FPS75 are:

Sides and rear - 2" Front - 6" Top - 24"



#### Exterior Clearances: FPS FPSE

Exterior installation clearance requirements are crucial and must be met to ensure compliance with all safety and code requirements. If all clearances cannot be met, do not unpack the heater.

All exterior clearance requirements for the FPS and FPSE are measured from the vent termination.

Min. clearances for side wall venting:

Inside corner - 3'

Side of door or window - 4'

Above door or window - 1'

Below a window - 4'

Above public walkway - 7'

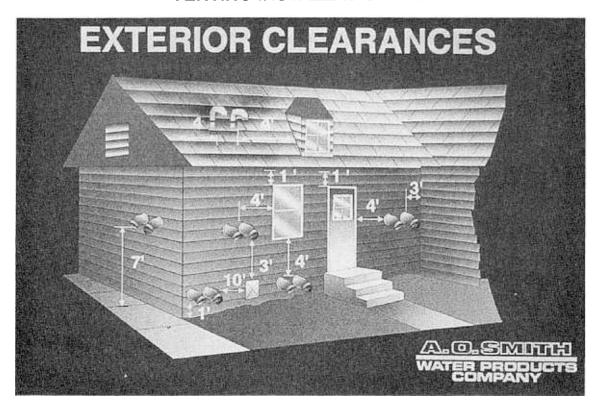
Above ground or snow level -1'

Air intake to a living space - 3' above if air intake is within 10'

Min. clearances for vertical:

1' above or 4' to the side of any gable, dormer, or roof structure with building interior access.

1' above snow level.



#### Exterior Clearances: FPD

Exterior installation clearance requirements are crucial and must be met to ensure compliance with all safety and code requirements. If all clearances cannot be met, do not unpack the heater.

All exterior clearance requirements for the FPD are measured from the vent termination.

Min. clearances for side wall venting:

Inside corner - 3'

Side of door or window - 9"

Above door of window - 9"

Above public walkway - 7'

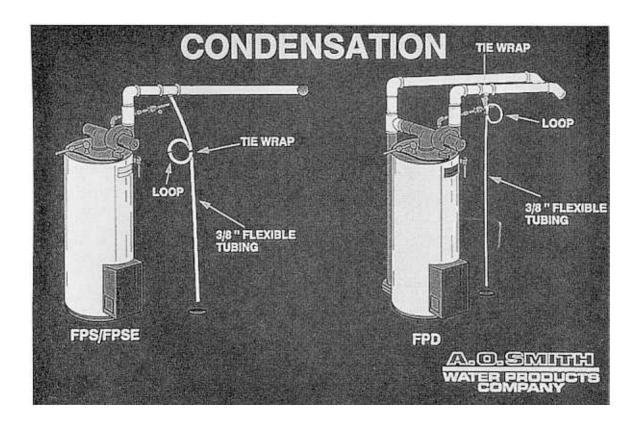
Above ground or snow level -1'

Min. clearances for vertical:

1' above or 4' to the side of any gable, dormer, roof structure with building interior access.

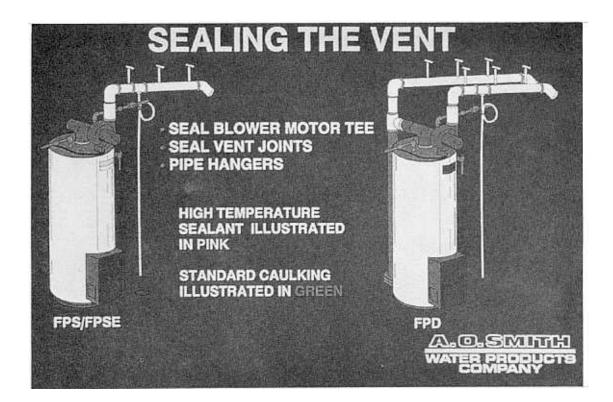
1' above snow level.

Air intake to a living space - 3' above if air intake is within 10'



Condensation:

FPSE FPD In certain installations, you may experience condensation in the venting. This will be most prevalent in the colder climates and especially with relatively long runs of venting in unheated rooms. To prevent the damaging condensation from draining into the blower and/or water heater, install the condensate tee provided with the heater. It goes in the exhaust vent as close as possible after the blower elbow. Attach a 3/8" plastic tube for the drain as shown. Configure a loop in the tube at least 1' down from tee to prevent flue gases from escaping. Install the venting with a slight downward slope toward the termination end. This slope should be no more than 1/8" per 5 feet of horizontal run no more than 1" total max.



Sealing the Vent:

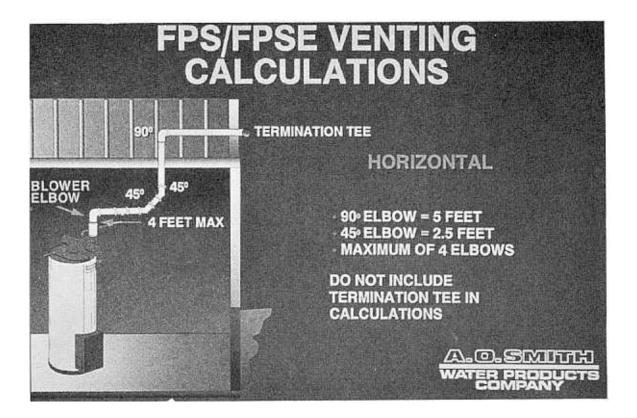
**FPS** 

**FPSE** 

FPD

Proper sealing of the vent system is essential for correct operation of the heater. On the initial firing of the heater, check all joints in the system for a proper seal, especially where the blower motor joins the heater, and at the PVC vent pipe connects to the blower. If a blower joint leaks air, it should be caulked with the high temperature silicone sealant provided. Other joints may be sealed with standard caulking. The vent system should be supported every (3) feet of vertical run and every five (5) feet of horizontal run.

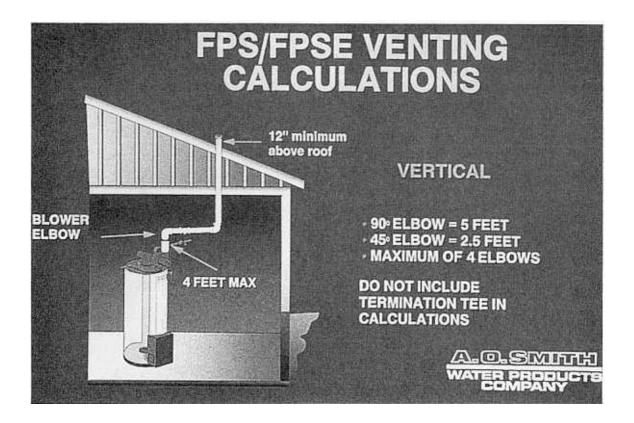




Horizontal Venting Calculations: FPS FPSE As you can see, the FPS & FPSE40 - 50 models allow for increased venting flexibility. They can be vented horizontally up to a maximum of 45 equivalent feet from the heater. Do not include termination tee in calculations.

FPS75 can be vented horizontally up to a maximum of 25 equivalent feet from the heater. Do not include the termination tee in calculations.

Excluding the termination tee, you can have no more than four elbows in the vent system.

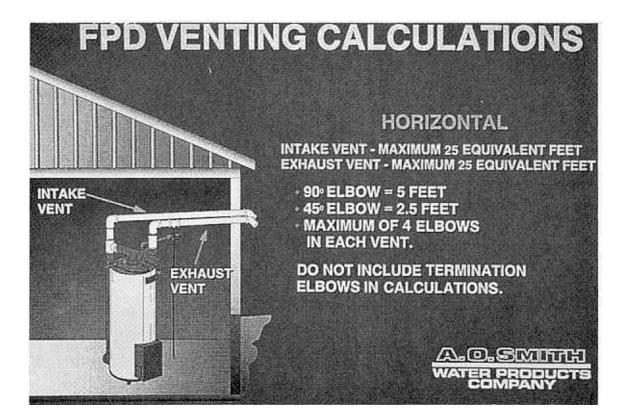


Vertical Venting Calculations: FPS FPSE

The FPS and FPSE40 - 50 can be vented vertically up to 35 equivalent feet from the heater.

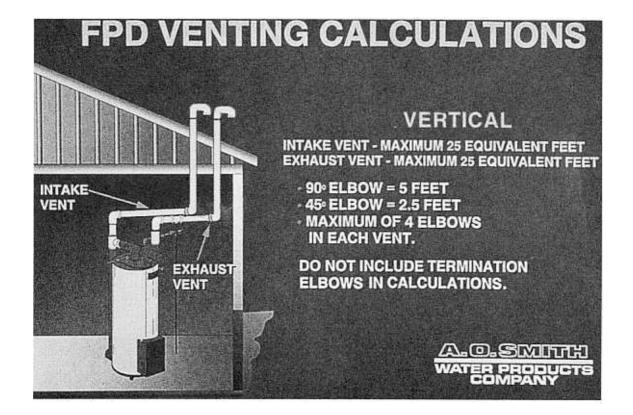
The FPS75 can be vented vertically up to 25 equivalent feet from the heater.

A minimum of 1 foot must be maintained between to roof or anticipated snow level and the termination tee.

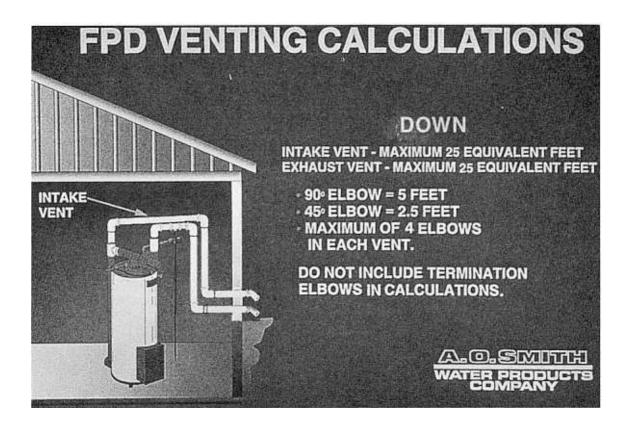


Horizontal Venting Calculations: FPD The FPD Sealed Shot features a two pipe system with a fresh air intake vent and an exhaust vent. Intake and exhaust elbows must be on same surface of the house. A maximum of 25 equivalent feet may be used in the intake vent system and a maximum of 25 equivalent feet may also be used in the exhaust vent. However, excluding the termination elbow, you can have no more than four elbows in each vent.

Since improper venting is a chief cause of heater malfunction, careful planning and adherence to these venting requirements will minimize service calls and ensure proper operation.

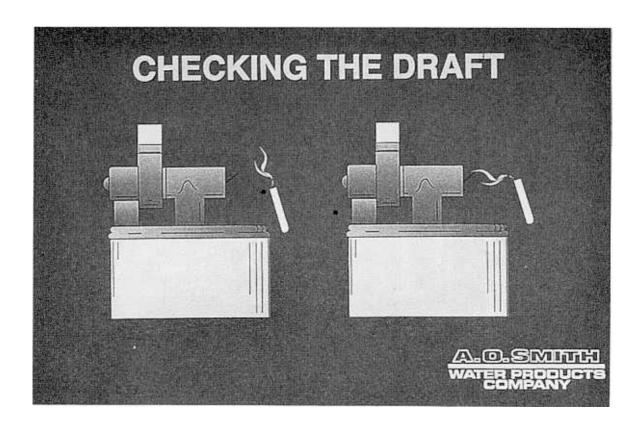


Vertical Venting Calculations: FPD This unit is approved for venting through the roof with only the terminations supplied with the unit. Intake and exhaust elbows must be on same surface of the house. Excluding the vent terminations, a maximum of 25 equivalent feet may be used in the intake vent system and a maximum of 25 equivalent feet may be used in the exhaust vent. However, excluding the termination elbow, you can have no more than four elbows in each vent.



Down Venting Calculations: FPD Intake and exhaust elbows must be on same surface of the house. Excluding the vent terminations, a maximum of 25 equivalent feet may be used in the intake vent system and a maximum of 25 equivalent feet may be used in the exhaust vent. However, excluding the termination elbow, you can have no more than four elbows in each vent.

#### AIR FOR COMBUSTION



#### Checking for Draft

On initial start up, check for the correct draft on the Power Shot. To check the draft, place a smoke stick directly in front of the inlet air damper while the heater is firing. A properly operating system will draw the smoke into the inlet air damper as shown in the right illustration. The illustration on the left shows a negative

To check for a negative condition close all windows, outside doors, and fireplace dampers. Turn on all exhausting appliances, including kitchen draft hoods, clothes dryers, furnaces, bathroom vents, etc. Open all inner doors between these appliances and the Power Shot.

Once all appliances are on and inner doors open, open the inlet air damper on the Power Shot when the heater is not firing. Using your hand, check for air movement. If air is being blown back into the room, a negative pressure condition exists.

CONDITION	CAUSE	SOLUTION
Burnt gas odor when heater is operating	Leaking vent joints	Seal vent joints
	Blocked vent	Clear vent blockage

The majority of the complaints associated with the operation of the will likely be a direct result of improper venting. If the customer complains of smelling burnt gas around the water heater, first check for vent gases that may be leaking from the PVC joints or around the area between the blower assembly and water heater. Seal all leaks with the high temperature silicone sealant provided.

Check for restrictions in the venting that may cause some spillage of burnt gas into the room and check your draft, visually inspecting the vent termination for blockage, clearing blockage as necessary.

CONDITION	CAUSE	SOLUTION
Sooting.	Inlet air damper not operational	Correct operation of inlet air damper
Moisture in tube on blower.	Condensation	Install condensate tee
Pilot Outage or pilot gas gas odor on standby.	Insufficient make-up air or back- drafts in vent	Install make-up air ducts

Improper venting is also a major cause of sooting in water heaters. If you experience sooting with the POWER SHOT®, check that the inlet air damper swings freely and opens 1 1/4" when the blower is running.

If water is dripping from the blower, condensate is the culprit. To correct the problem, install a condensate tee, and pipe to drain.

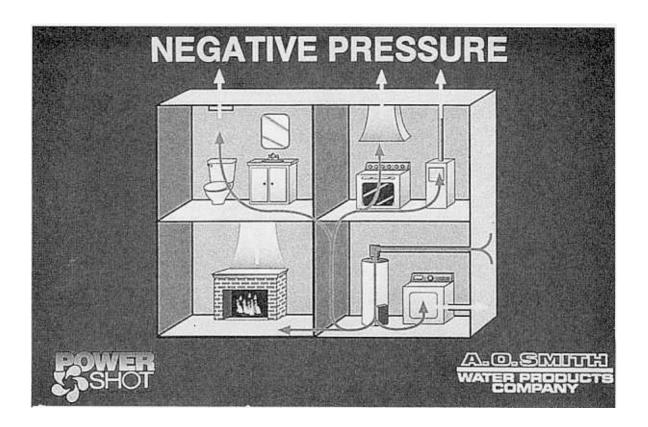
If the customer complains of nuisance pilot outage or pilot gas odor on standby, this may be due to a lack of combustion air, or other appliance (exhaust fans, clothes dryers, etc.) creating a backdraft in the FPS venting. In either case, install additional make-up air ducts.

CONDITION	CAUSE	SOLUTION
Excessive heat build-up in PVC venting	Inlet air damper not opening completely	Free air damper
	Blower does not run when main burner fires	Replace entire blower assembly
	Wrong main burner orifice size	Install correct orifice
Intermittent fan cycling without burner operation (Propane Only)	Build up of pressure in the main burner tube between thermostat gas valve and solenoid gas valve	If cycling occurs more than twice per hour, see troubleshooting procedures.

A malfunctioning vent damper may also cause excessive heat buildup in the PVC vent piping If unable to free the damper, replace the entire combustion control tee.

If blower does not run when the main burner fires, replace the control box. Also check burner orifice for correct size.

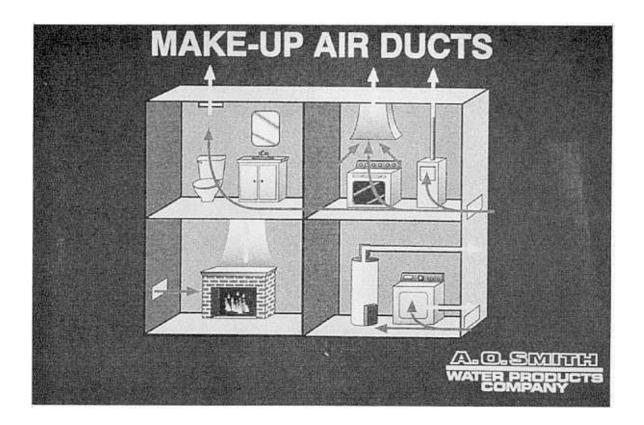
Intermittent cycling of the fan, without main burner operation, indicates a build-up of pressure in the main burner tube between the thermostatic gas valve and solenoid gas valve.



#### Negative Pressure

Diagnosing pilot outage complaints requires an examination of the environment in which the heater is installed. Mechanical vent fans are the chief cause of negative pressure. If the house is too tight, more air will be exhausted from the structure than is being brought in from the outside, resulting in a negative pressure condition. Fireplaces, furnaces, wind, and thermal stacking within the house can also play a role in creating negative pressure conditions.

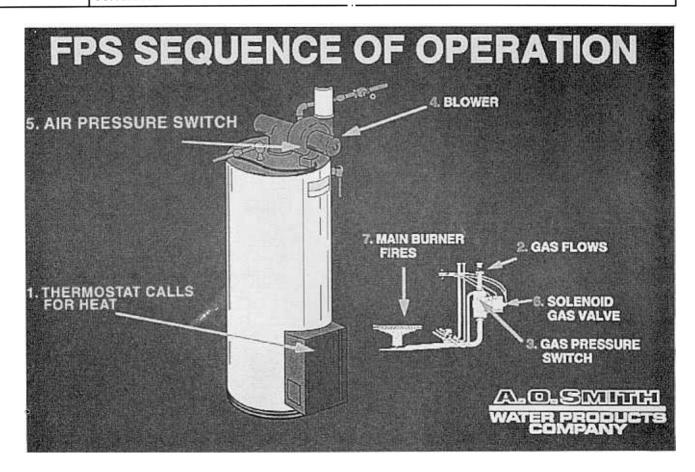
Negative pressure can result from air being backdrafted through the water heater vent down into the combustion chamber, blowing out the pilot. This may happen randomly because it may be a particular combination of appliances which cause the condition.



Make-up Draft To alleviate a negative pressure condition, install makeup air ducts (per makeup air specifications listed in the National Fuel Gas Code) of sufficient capacity to allow all appliances requiring makeup air to operate properly.

#### Service & Operation Introduction

Most problems will first appear as blower malfunctions; either a blower that does not run or a blower that runs constantly. In these instances, further trouble shooting is required to determine the exact cause. Familiarize yourself with the sequence of operation, study the wiring diagram, and complete the preliminary checks, then if those are OK, go to the section of this workbook that applies to the condition and follow the tests.

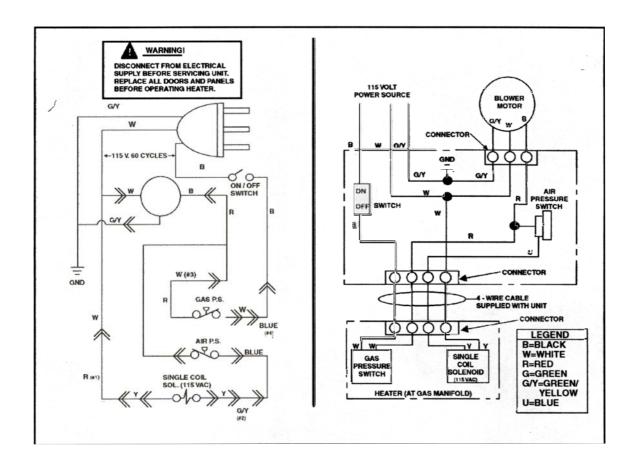


#### Sequence of Operation

- Thermostat calls for heat,
- 2 Main gas valve opens,
- 3 Gas pressure switch closes,
- 4 Fan activates,
- 5 Air pressure switch closes,
- 6 Solenoid opens,
- 7 Main burner ignites.

1

Wiring Diagram The following wiring diagram only applies to model FPS40 -50 series 226 - 227.



#### Troubleshooting

To troubleshoot the FPS you must understand its sequence of operation. Review that section if necessary. In addition, installation problems can cause the heater to malfunction. Review sections on venting and checking draft. Most problems with the heater will first appear as blower malfunctions.

Subject	Page
Preliminary Checks	Pages 24 and 25
Blower does not run	Page 26
Blower runs constantly (No call for heat)	Page 30
Blower runs constantly (No main burner)	Page 34
Pilot Problems	Page 38
Main Burner Problems	Page 39

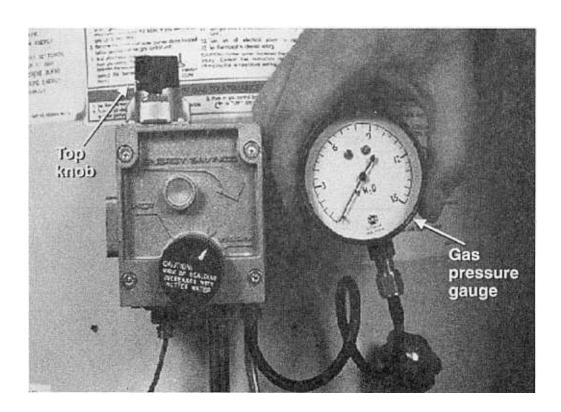
#### Troubleshooting cont.

PRELIMINARY CHECKS	(a) Tata (state)
Gas valve knob is in ON position.	
2. Pilot is burning.	754
3. 120 VAC is supplied to heater.	
4. Thermostat is calling for heat (See page 25)	meson reco
5. Blower ON/OFF switch is in the ON position.	on and the second
6. Connection between blower motor and blower cor	ntrol box is secure.
7. Heater is installed per manual.	

RESULTS If:	then:
Any of the Preliminary Checks reveal a problem,	repair or replace these items as you would on any standard residential gas water heater.

inserting the jumper wire. Then turn the switch back on. Use <b>extreme caution</b> as you may be working with 120 VAC.		
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Troubleshooting cont.



#### PRELIMINARY THERMOSTAT TEST

#### **SET UP THE TEST**

- Place top knob on gas valve to "OFF" position,
- remove pressure tap set screw from bottom of gas valve,
- connect gas pressure gauge to gas pressure tap, relight pilot,
- rotate thermostat dial to call for heat, then
- place top knob on gas valve to "ON" position. (Caution: check for gas leaks)

RESULTS If the gas pressure gauge:	then:
does not pressurize to read (4.0 " w.c. natural gas or 10 " w. c. propane gas),	replace the valve.
does pressurize to read (4.0 " w.c. natural gas, 10 " w c. propane gas)	the gas valve is OK. Continue to Step 1 of the troubleshooting procedures.

#### Troubleshooting cont.

#### **BLOWER DOES NOT RUN**

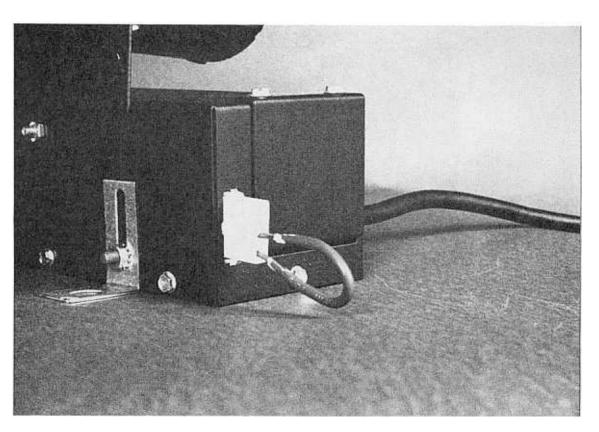
First make the **Preliminary Checks** (see page 24), then perform each of the following tests until cause of the failure is determined:

- 1. Blower Test
- 2. Cable Test
- 3. Harness

#### Cautions

When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

Troubleshooting cont. BLOWER DOES NOT RUN cont.



## S T 1 E

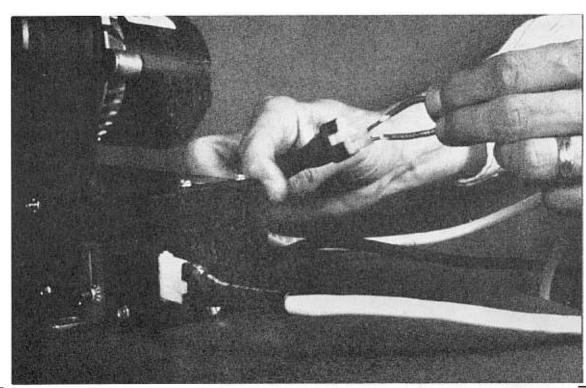
## **BLOWER TEST**

#### **SET UP THE TEST**

- Disconnect the 4 wire cable from the fan control box, then
- using an insulated jumper wire (caution 120 VAC), jump between pins 3 and 4 on receptacle as shown.

RESULTS	
lf:	then:
the fan does not run,	replace the fan assembly.
the fan does run,	go to Step 2.

Troubleshooting cont. BLOWER DOES NOT RUN cont.



## S T 2 E

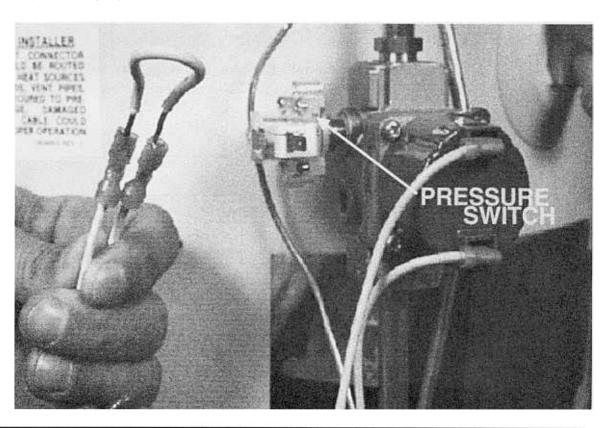
## **CABLE TEST**

#### **SET TEST UP**

- Reconnect the 4 wire cable onto the fan control box,
- disconnect the cable from the control cover below, then
- using an insulated jumper wire, jump between pins 3 and 4 on plug as shown.

RESULTS If:	then:
the fan does not run,	replace the cable.
the fan does run,	go to Step 3.

Troubleshooting cont. BLOWER DOES NOT RUN cont.



## S T 3 E P

## **HARNESS TEST**

#### **SET UP THE TEST**

- Reconnect the 4 wire cable onto control box cover,
- disconnect the 2 wires from the gas pressure switch, then
- using an insulated jumper wire, jump between the 2 wires as shown.

RESULTS If:	then:
the fan does not run,	replace the harness.
the fan does run,	replace the gas pressure switch.

#### Troubleshooting cont.

#### **BLOWER RUNS CONSTANTLY**

(NO CALL FOR HEAT)

First make the **Preliminary Checks** (see page 24), then perform each of the following tests until cause of the failure is determined:

- 1. Blower Test
- 2. Cable Test
- 3. Harness Test

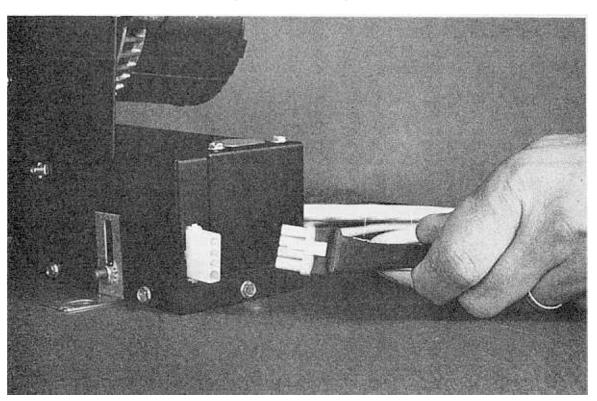
### PRELIMINARY CHECKS EXCEPTIONS

4. Thermostat should not be calling heat. (See page 25)

#### **Cautions**

When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

Troubleshooting cont. BLOWER RUNS CONSTANTLY (No call for heat) cont.

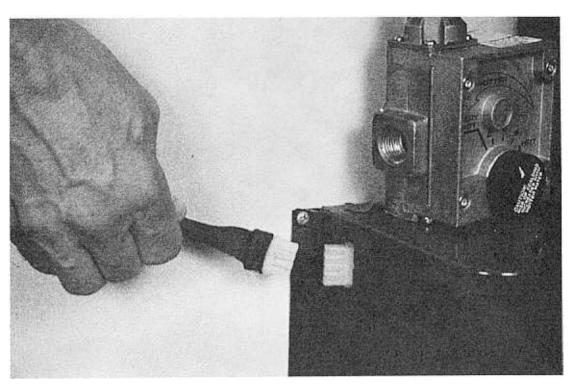


# BLOWER TEST SET UP THE TEST

Γ 1 Ε - Disconnect the 4 wire cable from the fan control box as shown.

RESULTS If:	then:
the fan continues to run,	replace the fan assembly.
the fan stops,	go to Step 2.

Troubleshooting cont. BLOWER RUNS CONSTANTLY (No call for heat) cont.



## CABLE TEST

S T 2 F

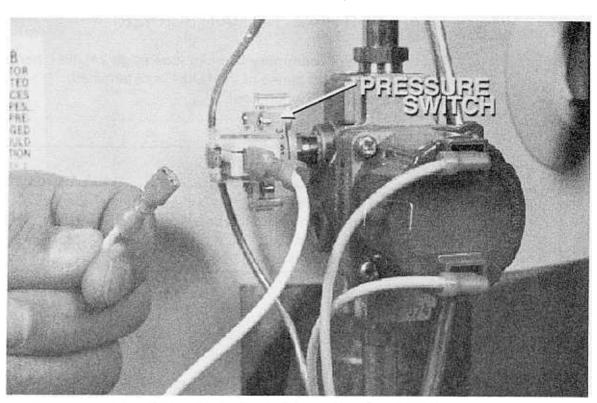
#### SET UP THE TEST

- Reconnect the 4 wire cable onto the fan control box, then
- disconnect the cable from the control box cover below as shown.

RESULTS If:	then:
the fan continues to run,	replace the cable.
the fan stops,	go to Step 3.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (No call for heat) cont.



## S T 3

## **HARNESS TEST**

#### **SET UP THE TEST**

- Reconnect the 4 wire cable onto the control box cover, then
- disconnect one of the wires from the gas pressure switch as shown.

RESULTS If:	then:
the fan continues to run,	replace the harness.
the fan stops,	replace the gas pressure switch.

#### Troubleshooting cont.

## **BLOWER RUNS CONSTANTLY**

(CALL FOR HEAT, NO MAIN BURNER)

First make the **Preliminary Checks** (see page 24), then perform each of the following tests until cause of the failure is determined:

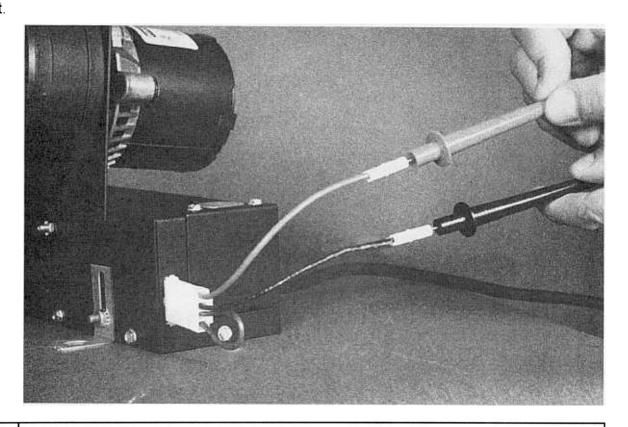
- 1. Air Pressure Switch Test
- 2. Cable Test
- 3. Harness Test

#### **Cautions**

When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (No main burner) cont.



## S T 1 E

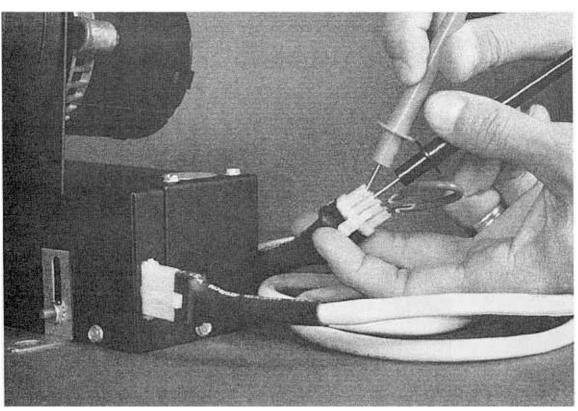
## AIR PRESSURE SWITCH TEST

#### **SET UP THE TEST**

- Disconnect the 4 wire cable from the fan control box,
- using an insulated jumper wire, jump between pins 3 and 4 on the receptacle, then
- using a multimeter, test for 120 VAC between pins 1 and 2 as shown.

RESULTS If:	then:
the meter does not read 120 VAC,	replace the air switch.
the meter does read 120 VAC,	go to Step 2.

Troubleshooting cont. BLOWER RUNS CONSTANTLY (No main burner) cont.



# S T 2

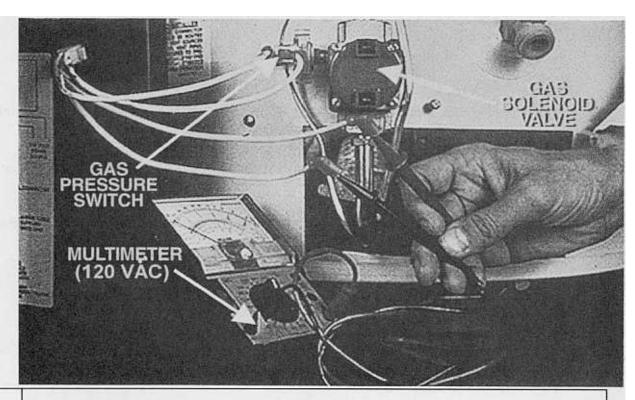
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# **CABLE TEST**

- Reconnect the 4 wire cable to the fan control box,
- disconnect the 4 wire cable from the control box cover below,
- using an insulated jumper wire, jump between pins 3 and 4 on the plug, then
- using a multimeter, test for 120 VAC between pins 1 and 2 as shown.

RESULTS If:	then:
the meter does not read 120 VAC,	replace the cable.
the meter does read 120 VAC,	go to Step 3.

Troubleshooting cont. BLOWER RUNS CONSTANTLY (No main burner) cont.



# S T 3 E

# HARNESS TEST

- Reconnect the 4 wire cable to the control box cover,
- disconnect the 2 wires from the solenoid, then
- using a multimeter, test for 120 VAC between wires as shown.

RESULTS	
lf:	then:
the meter does not read 120 VAC,	replace the harness.
the meter does read 120 VAC,	replace the solenoid.

Trouble- shooting cont.	PILOT PROBLEMS		
	The following are possible causes of pilot problems:		
	Incorrect pilot position; the pilot should engulf the tip of the thermocouple 3\8" to 1\2".		
	Incorrect thermocouple output; it should generate 7 or more millivolts when pilot is burning.		
	Incorrect pilot gas pressure; it should be 3.5" for natural gas and 10" for propane.		
	Excessive equivalent foot length on vents can cause pilot outages.		
	5. Backdraft can cause pilot outages. (See page 16).		
	6. An open E.C.O. will not allow the heater to be relit.		
	7. A leak in the pilot tube will cause candling.		

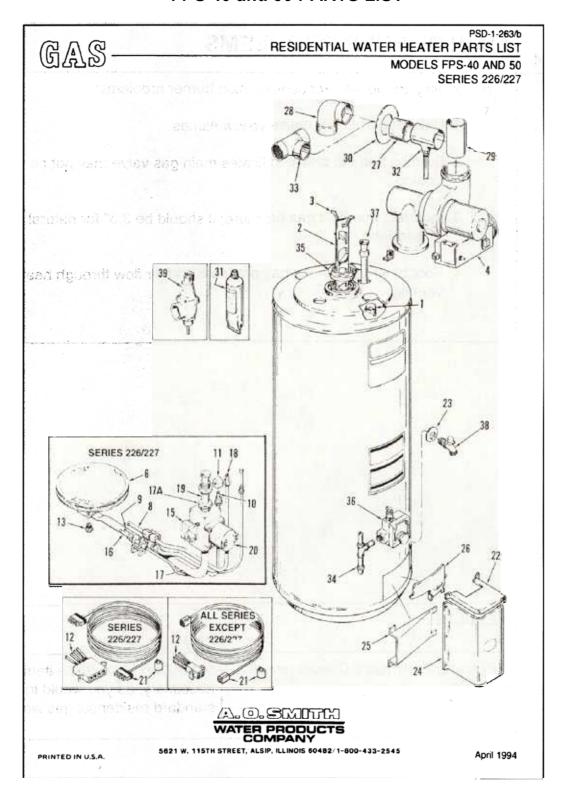
RESULTS If:	then:	
Any of these seem to be the problem,	repair or replace these items, if necessary, as you would in on any standard residential gas water heater.	

Trouble-shooting cont.  MAIN BURNER PROBLEMS		MAIN BURNER PROBLEMS	
		The following are possible causes of main burner problems:	
		Unlevel burner will cause yellow flames.	
		Burning and the orifice indicates main gas valve may not be fully closing.	

- 3. Incorrect manifold gas pressure; it should be 3.5" for natural gas and 10" for propane.
- 4. Soot build-up. Check gas pressure and air flow through heater and venting.

RESULTS If:	then:
Any of the Preliminary Checks reveal a problem,	repair or replace these items, if necessary, as you would in on any standard residential gas water heater.

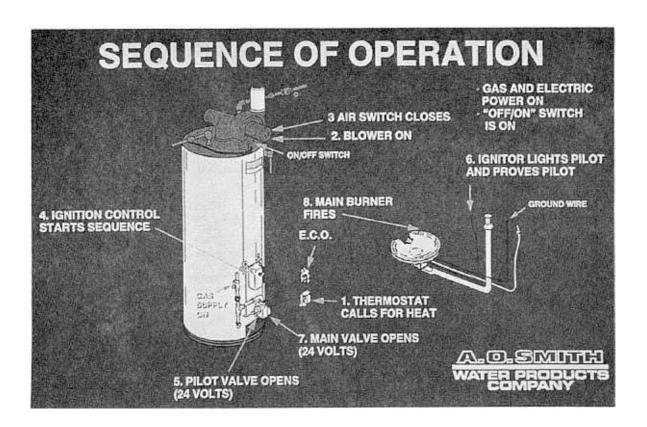
## FPS 40 and 50 PARTS LIST



	Description	Series 2		
Hem	Description	FPS-40	FPS-50	
1	Anode	43817-25	43817-38	
2	Baffle, Flue	181382	181382	
3	Baffle, Hanger	181360	181360	
4		181920	181920	
5	Biower, Assembly Burner Assembly Natural	181936	181936 2	
	Burner Assembly Propane .	181936-1	181936-3	
6	Burner Head	181806	181806	
7	Burner with Pilot (Including Item 14)	101000	101000	
'	Natural Gas			
	Propane Gas			
8	Burner Pilot, Natural	181805-3	181805-3	
	Burner Pilot, Propane	181805-2	181805-2	
9	Bleed Pilot, Natural Only	181804-2	181804-2	
10	Bleed Tube, Natural Only	23330	23330	
11	Bleed Elbow. Natural Only	181825	181825	
12	Harness, Wiring	181890	18189C	
13	Orifice, Main Burner, Natural	181508-31	181508-31	
	Orifice, Main Burner, Propane	181791-50	181 791-50	
14	Orifice, Pilot, Natural		10.730	
	Oritice, Pilot. Propane			
	Switch, Pressure, Natural			
15		180997-1	180997-1	
	Switch, Pressure, Propane Thermocouple	181044-1	181044-1	
16		23675	23675	
17	Tube, Lower Burner, Natural	191887	181887-1	
	Tube, Lower Burner, Propane	181914	181914-1	
17A	Nut-Optic (Use with Item 17 & 19)			
18	Tube, Priot	23330	23330	
19	Tube Honer Russes	18:192	181192	
20	Valve Solenoid Natura	181916	181916	
	Valve Salenoid Propane	181917	181917	
21	Cable Control w/Clips	181728-1	1B* 728-1	
22	Cable, Control w/Clips	181286	181286	
23	Color Pag	20172-14	20172-14	
24	Court Con Control Street	Mile Committee	그 그 그 그 그 그 그 그 그 가는 사이 아니라면 내 가는 사이 가게 있는 아니라면 없다면 생각을 했다.	
CTO CONTRACTOR	Collar, Pipe Cover, Gas Control String	180540-1	180540-1	
25	Dog: Burner Companinem		181255 700	
26	Door, Inner	180596	180596	
	Kit. Vent Pipe			
27	Caupling	• • •		
28	Elbow, Discharge with Screen			
29	Pipe. P.V.C. 3" x 12"	181531	181531	
30	Plate Outer/Inner Wall	181557	181557	
*31	Sealer, Tube High Temp. Silicone Sealant	181564	181564	
32	Tee. Condensate Assembly	181861	181861	
33	Tee, Discharge with Screen	181617	181617	
34	Leg, Dirt Assembly (Propage Only)	181206	181206	
35	Restrictor, Flue			
4.0	Thermostat Natural	34894	34894	
36		180193-5	180193-5	
	Thermostat Propane	181775-2	181775-2	
37	Tube, Inlet	21062-26	21062-31	
38	Valve Drain	42037	42037-1	
39	Vave. T & P .	43151-2	43151-2	
	<ul> <li>Sealant must conform to MIL-A-46106A, type 1/FDA21 Cl</li> </ul>	FR 175.300. M	ust be able to withstand constant	
	high temperature of 450°F and a low of -75°F. Equal to N	Internal Deluma	Denginte Conton II	

#### Service & Operation Introduction

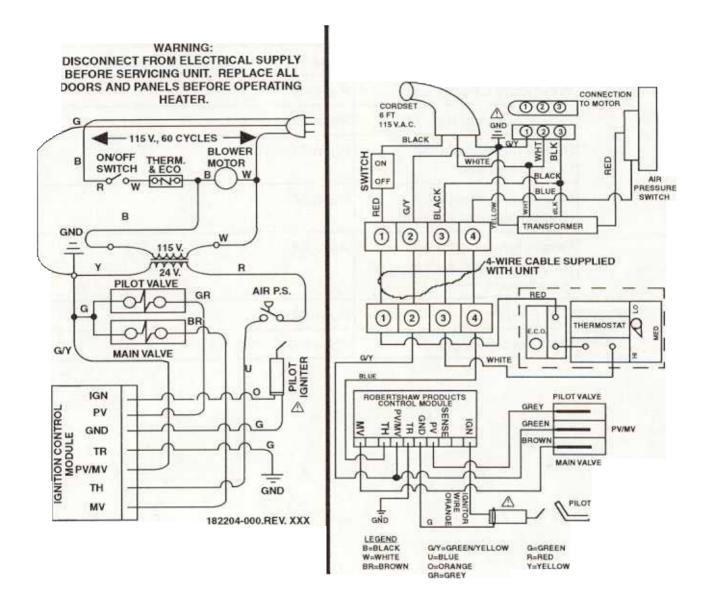
Most problems will first appear as blower malfunctions; either a blower that does not run or a blower that runs constantly. In these instances, further trouble shooting is required to determine the exact cause. Familiarize yourself with the sequence of operation, study the wiring diagram, and complete the preliminary checks, then if those are OK, go to the section of this workbook that applies to the condition and follow the tests.



Sequence	of
Operation	

- 1 Thermostat calls for heat,
- 2 Blower activates,
- 3 Air pressure switch closes,
- 4 Ignition starts,
- 5 Pilot valve opens,
- 6 Ignitor lights pilot and proves pilot,
- 7 Main valve opens,
- 8 Main burner ignites.

Wiring Diagram This wiring diagram only applies to models FPSE 40 & 50 series 226E and models FPD 40 & 50 series 226 - 227.



## Troubleshooting

To troubleshoot the FPSE and FPD you must understand its sequence of operation. Review that section if necessary. In addition, installation problems can cause the heater to malfunction. Review sections on venting and checking draft. Most problems with the heater will first appear as blower malfunctions.

Subject	Page
Preliminary Checks	Page 45
Blower does not run	Page 46
Blower runs constantly (No call for heat)	Page 51
Blower runs constantly (Calling for heat, no pilot)	Page 54
Blower runs constantly (Calling for heat, pilot is lit, no main burner)	Page 61
Pilot Problems	Page 64
Main Burner Problems	Page 65

Trouble-	
shooting	cont.

# PRELIMINARY CHECKS

- 1. Gas valve knob is in ON position.
- 2. 120 VAC is supplied to heater.
- 3. Thermostat is calling for heat. (See page 50)
- 4. Blower ON/OFF switch is in the ON position.
- 5. Connection between blower motor and blower control box is secure.
- 6. High limit is closed. (See page 49)
- 7. Heater is installed per manual.

RESULTS If:	then:
Any of the Preliminary Checks reveal a problem,	repair or replace these items, if necessary, as you would in on any standard residential gas water heater.

#### **Cautions**

When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

## Troubleshooting cont.

## **BLOWER DOES NOT RUN**

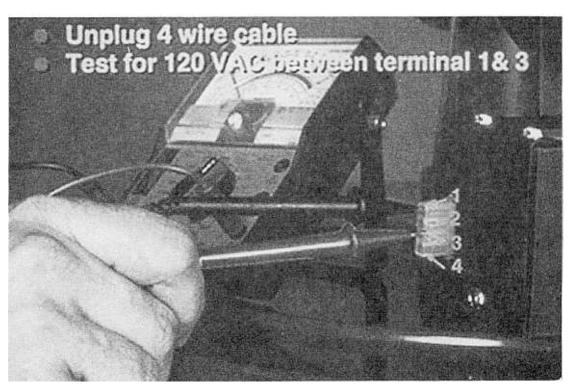
First make the **Preliminary Checks** (see page 45), then perform each of the following tests until cause of the failure is determined:

- 1. Blower Test
- 2. Cable Test
- 3. High Limit Test
- 4. Thermostat Test

#### Cautions

When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

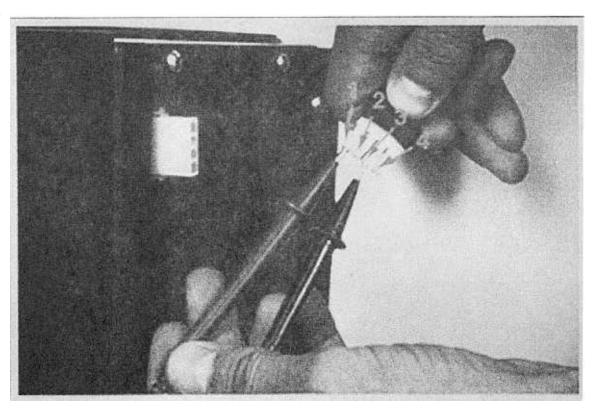
Troubleshooting cont. BLOWER DOES NOT RUN cont.



# S T 1 SET UP THE TEST - Disconnect the 4 wire cable from the blower control box, then - using a multimeter, test for 120 VAC between pins 1 and 3 on the control box receptacle as shown.

RESULTS If:	then:	
the meter does not read 120 VAC,	replace the blower assembly.	
the meter does read 120 VAC,	go to Step 2.	

Troubleshooting cont. BLOWER DOES NOT RUN cont.



# S T 2 E

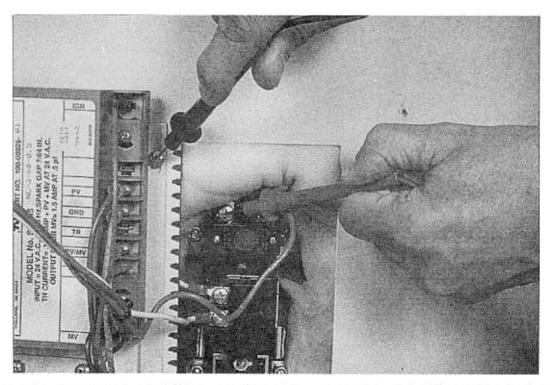
# **CABLE TEST**

#### **SET TEST UP**

- Reconnect cable to blower control box,
- disconnect cable from receptacle on door below, then
- using a multimeter, test for 120 VAC between pins 1 and 3 on the cable plug as shown.

RESULTS	V	
lf:	then:	
the meter does not read 120 VAC,	replace the cable.	
the meter does read 120 VAC,	go to step 3.	

Troubleshooting cont. BLOWER DOES NOT RUN cont.



# S T 3 E

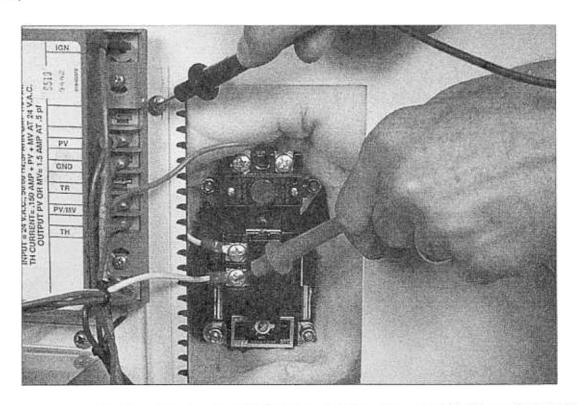
# **HIGH LIMIT TEST**

- Reconnect cable to the receptacle on the door,
- remove front cover from the door,
- inspect the wire from connector to the high limit for lack of continuity or loose connections, correct either of these conditions if necessary,
- make sure the red button on the high limit is depressed,
- using a multimeter, test for 120 VAC at screw on high limit and ground as shown.

RESULTS	Taring and the second		
lf:	then:		
the meter does not read 120 VAC,	replace high limit.		
the meter does read 120 VAC,	go to Step 4.		

Trouble-shooting cont.

BLOWER DOES NOT RUN cont.



# THERMOSTAT TEST

5 T 4

- Adjust the thermostat to call for heat, then
- using a multimeter, test for 120 VAC at screw on thermostat and ground as shown,
- inspect the wire from thermostat to 4 pin connector for lack of continuity or loose connections, correct either of these conditions if necessary.

RESULTS If:	then:
the meter does not read 120 VAC ,	replace the thermostat.
the meter does read 120 VAC ,	go to Step 1 of the troubleshooting procedures.

#### Troubleshooting cont.

## **BLOWER RUNS CONSTANTLY**

(NO CALL FOR HEAT)

First make the **Preliminary Checks** (see page 45), then perform each of the following tests until cause of the failure is determined:

- 1. Blower Test
- 2. Cable Test

## PRELIMINARY CHECKS EXCEPTIONS

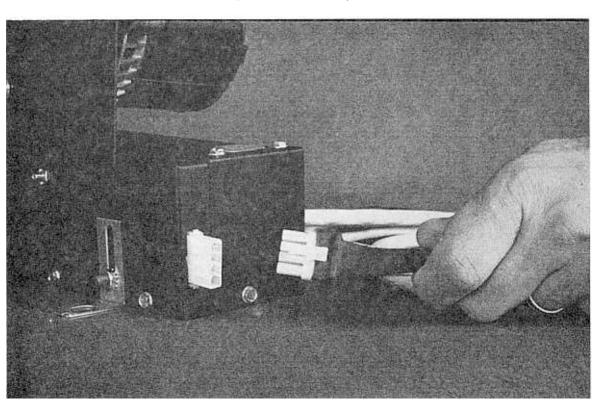
4. Thermostat should not be calling for heat. (See page 50)

#### **Cautions**

When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (No call for heat) cont.



# S T 1 E

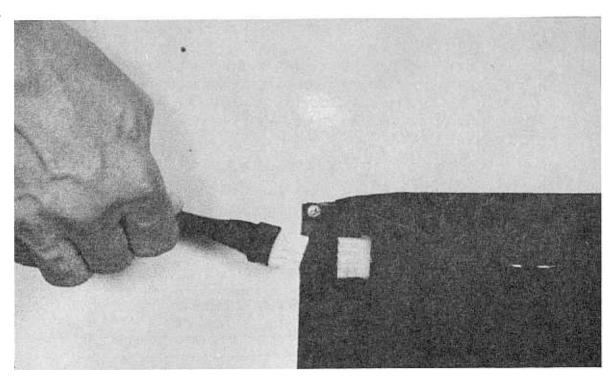
# **BLOWER TEST**

#### **SET UP THE TEST**

- Disconnect the 4 wire cable from the blower control box as shown.

RESULTS If:	then:
the blower continues to run,	replace the blower.
the blower stops,	go to Step 2.

Troubleshooting cont. BLOWER RUNS CONSTANTLY (No call for heat) cont.



# S T 2

## **CABLE TEST**

#### **SET TEST UP**

- Reconnect cable to blower control box, then
- disconnect cable from receptacle on the door below as shown,
- inspect the wire from thermostat to 4 pin connector for lack of continuity or loose connections, correct either of these conditions if necessary.

RESULTS If:	then:
the blower continues to run,	replace the cable.
the blower stops,	see preliminary checks.

#### Troubleshooting cont.

## **BLOWER RUNS CONSTANTLY**

(CALLING FOR HEAT, NO PILOT)

First make the **Preliminary Checks** (see page 45), then perform each of the following tests until cause of the failure is determined:

- 1. Air Pressure Switch
- 2. Cable Test
- 3. TH Wire Test
- 4. PV-PV/MV Test
- 5. Spark Test
- 6. Pilot Valve

## PRELIMINARY CHECKS EXCEPTIONS

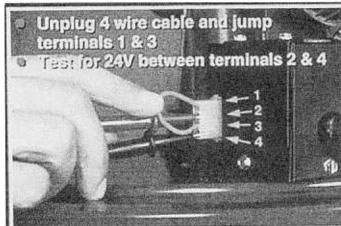
5. Turn ON\OFF switch off then on again to reset I.I.D. If module locks out (See page 64).

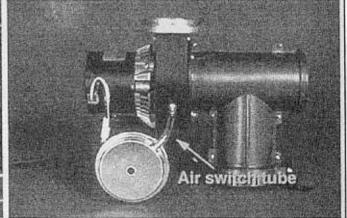
#### **Cautions**

When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.





## AIR PRESSURE SWITCH TEST

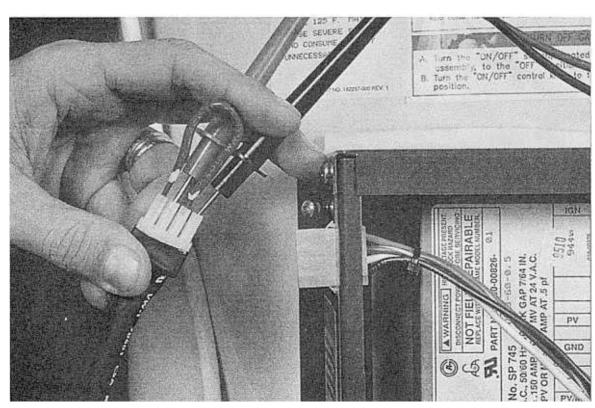
S T

E

- Disconnect the 4 wire cable from the blower control box.
- using an insulated jumper wire, jump between pins 1 and 3 (caution 120 VAC) on the receptacle, then
- using a multimeter, test for 24 VAC between pins 2 and 4 as shown.

RESULTS If:	then:
the meter does not read 24 VAC,	replace the pressure switch.
the meter does read 24 VAC,	go to Step 2.

Troubleshooting cont. BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



## **CABLE TEST**

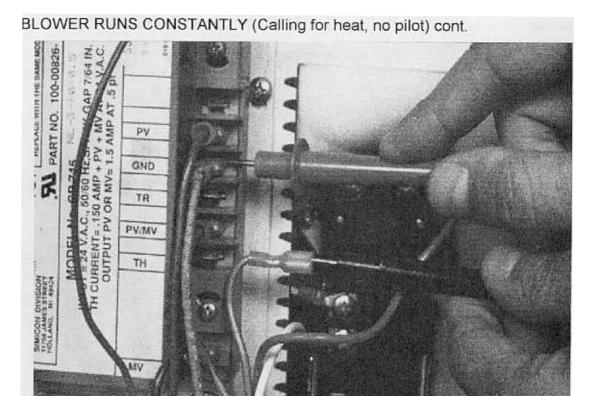
# S 2

Ε

- Reconnect the 4 wire cable to the blower control box,
- disconnect the cable from receptacle on door below,
- using an insulated jumper wire, jump between pins 1 and 3 (caution 120 VAC) on cable plug, then
- using a multimeter, test for 24 VAC between pins 2 and 4 as shown.

RESULTS If:	then:
the meter does not read 24 VAC,	replace the cable.
the meter does read 24 VAC,	go to Step 3

Troubleshooting cont.



Т

E

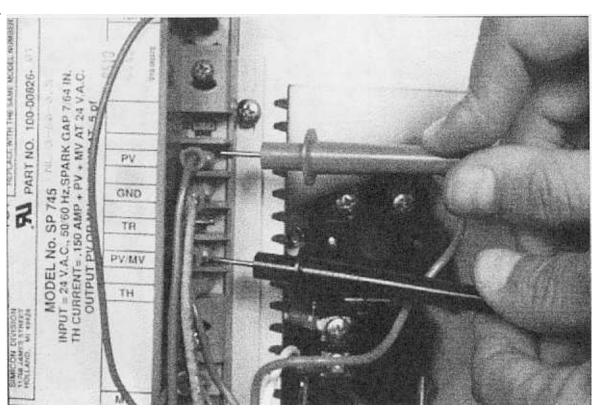
P

# TH WIRE TEST

- Reconnect the cable to receptacle on the door.
- remove front cover door,
- inspect the wire from the connector to the I.I.D. for lack of continuity or loose connections, correct any of these conditions if necessary, then
- using a multimeter, test for 24 VAC between TH wire and ground on the I.I.D. as shown.

RESULTS If:	then:
the meter does not read 24 VAC,	replace wire.
the meter does read 24 VAC,	go to Step 4.

Troubleshooting cont. BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



# PV - PV/MV TEST

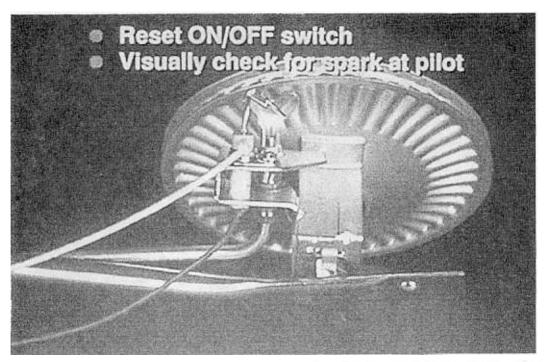
S T 4 E

P

- Reconnect wire to TH terminal to I.I.D.,
- using a multimeter, test for 24 VAC between PV (pilot valve) and PV/MV on the I.I.D. as shown.

RESULTS If:	then:
the meter does not read 24 VAC,	replace the I.I.D.
the meter does read 24 VAC,	go to Step 5.

Troubleshooting cont. BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



## **SPARK TEST**

## 5 T :

5

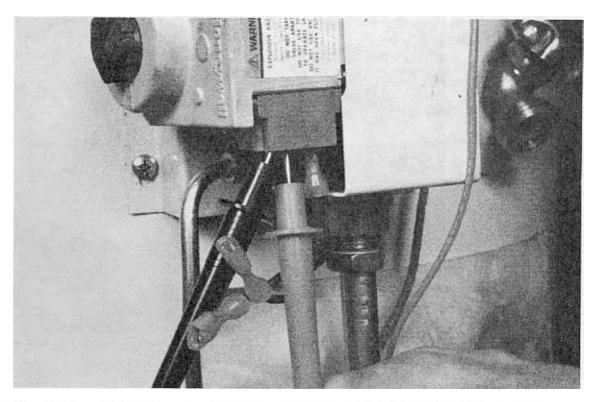
E

- Reset the ON/OFF switch, then
- visually check for spark at the pilot assembly.
- Sparking should stop as soon as pilot is lit. (If sparking continues, see page 64)

RESULTS If:	then:
the electrode is not sparking,	<ul> <li>check 7/64" spark gap between pilot hood and electrode.</li> <li>check spark cable continuity.</li> <li>check ground cable continuity at I.I.D.</li> </ul>
the electrode is sparking,	go to Step 6.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



## **PILOT VALVE TEST**

S T 6 E

- Inspect the wire from the I.I.D. to the pilot valve for lack of continuity or loose connections, correct any of these conditions if necessary,
- disconnect the wire from the pilot valve, then
- using a multimeter, test for continuity at pilot valve as shown.
- (If there are other problems with the pilot see page 64)

RESULTS		
lf:	then:	
the meter does not read continuity,	replace pilot valve.	
the meter does read continuity,	check gas supply.	

## Troubleshooting cont.

## **BLOWER RUNS CONSTANTLY**

(CALLING FOR HEAT, PILOT IS LIT, NO MAIN BURNER)

First make the **Preliminary Checks** (see page 45), then perform each of the following tests until cause of the failure is determined:

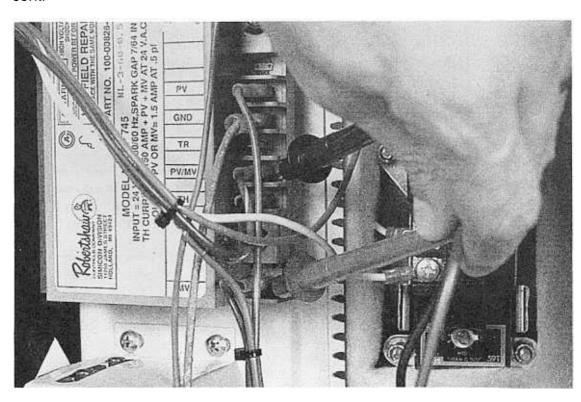
- 1. MV-PV/ MV Test
- 2. Main Valve

#### **Cautions**

When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, pilot is lit, no main burner) cont.



## **MV - PV/MV TEST**

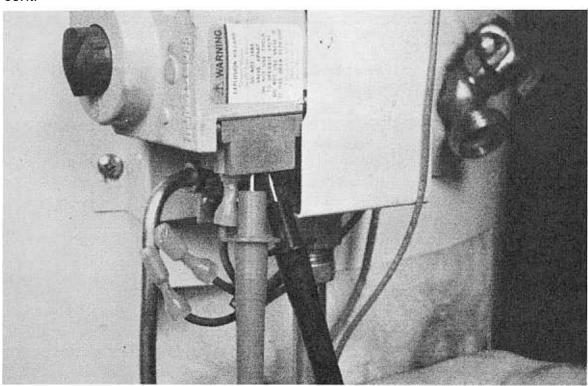
# S T 1 E P

## **SET UP THE TEST**

- using a multimeter, test for 24 VAC at MV (main valve) and PV/MV on I.I.D. as shown.

RESULTS If:	then:
the meter does not read 24 VAC,	replace the I.I.D.
the meter does read 24 VAC,	go to Step 2.

Troubleshooting cont. BLOWER RUNS CONSTANTLY (Calling for heat, pilot is lit, no main burner) cont.



# MAIN VALVE TEST

S T2

E

- inspect the wire from the I.I.D. to the main valve for lack of continuity or loose connections, correct any of these conditions if necessary,
- disconnect the wires from the main valve, then
- using a multimeter, test for continuity on main valve as shown.
- If there are other problems with the main burner (see page 65)

RESULTS If:	then:
the meter does not read continuity,	replace main valve.
the meter does read continuity,	check gas supply.

## Troubleshooting cont.

## **PILOT PROBLEMS**

The following are possible causes of pilot problems:

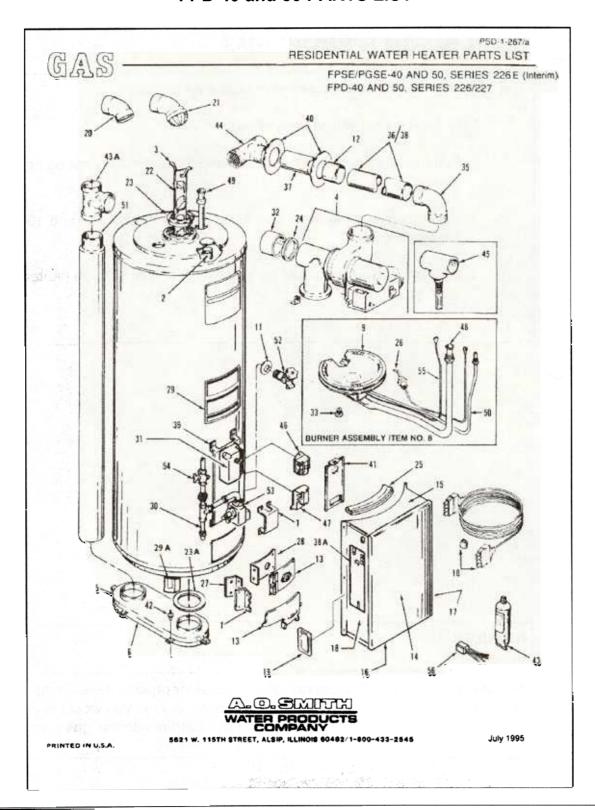
- 1. An open E.C.O. (high limit) will not allow the heater to relight. (See page 49)
- 2. Incorrect pilot gas pressure: it should be 3.5" w.c. for natural gas. It should be 10" w.c. for propane gas.
- 3. Incorrect excessive equivalent foot length on vents can cause pilot outages.
- 4. Incorrect pilot position: The pilot should engulf the tip of the flame sensor 3/8" to 1/2".
- A leak in pilot tube will cause candling.

RESULTS	
If:	then:
Any of these reveal a problem,	repair or replace these items, as you would on any standard residential gas water heater.

Trouble- shooting cont.	MAIN BURNER PROBLEMS					
	The following are possible causes of main burner problems:					
	Unlevel burner will cause yellow flames.					
	Burning and the orifice indicates main gas valve may not be fully closing.					
	Incorrect gas pressure; it should be 3.5" for natural gas and 10" for propane.					
	Soot build-up. Check gas pressure and air flow through heater and venting.					

RESULTS If:	then:
Any of the Preliminary Checks reveal a problem,	repair or replace these items, if necessary, as you would in on any standard residential gas water heater.

# FPSE 40 and 50 PARTS LIST FPD 40 and 50 PARTS LIST

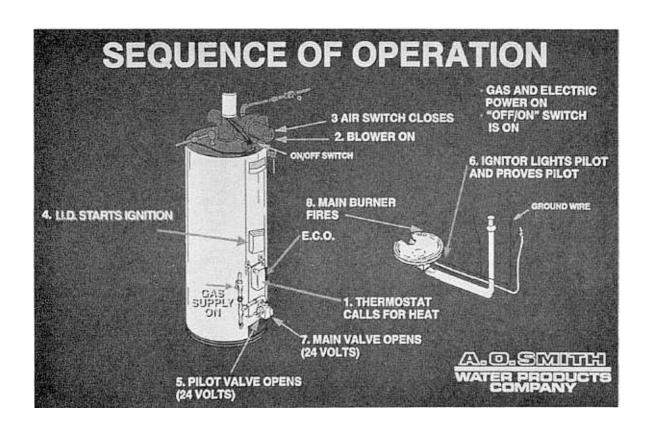


			Sames 3	22/223	Senes 22	6:227
			Senes 2 SE-40	FPSE-50	GRIPES 22	and the second
		-	The Party of the P		EBD-40	EPD EO
em	Description	203	SE 40	PGSE-50	FPD-40	FPD-50
1	Angle, Door Left				181450	181450
2	Anode	438	16-38	43816-38	43817-29	43817-35
3		181	360	181360	181360	181360
4	Blower Assembly	181	616	181616	181843	181843
5	Box Top, Lower Air Supply				181489	181489
5					181490	181490
7		181	709	181709	181898	181898
7	Bracket, Gas Valve, Series 227 Only				182194	182194
	Surner, Assembly					
	Natural Gas	181	732	181732-2	181732-12	181732-14
	Propane Gas	181	732-1	181732-3	181732-12	181732-14
4	Burner with Pilot					
	Natural Gas	181	726	181726	181726	181726
	Propane Gas		726-1	181726-1	181726-1	181726-1
)	Cable, Control w/Clips		728	181728	181728	181728
,	Collar, Pipe		72-14	20172-14	20172-14	20172-14
	Country Country	181			201/2114	20.12.14
?	Coupling	101	543 506	181543	181449	181449
1	Door, Inner		596	180596		
	Door Panel, Cover			181708	181943	181943
•	Door Panel, Top	181		181857	181942	181942
5	Door Panel, Bottom	181	858	181858	181941	181941
,	Door Panel, Right			181859	181940	181940
3	Door Panel, Left	181	860	181860	161939	181939
,	Door-Plug, Outer		733	181733		
1	Elbow Assembly, Exhaust, FPD Only				181528	181528
	Elbow Assembly, Intake, FPD Only				182167	182167
	Flue, Baffle			181362	181382	181382
3	Flue Restrictor			34894	34894	34894
A	Gasket, Fiberglass				182130	182130
	Gasket, Inlet Tee, FPD Only				181765	181765
				181764	181764-1	181764-1
	Grammet, Outer Door				181903	181903
	igniter			181734		
	Insulation, Angle				182132	182132
1	Insulation, Door				182131	182131
,	Label-Lighting & Operating		-	181719	182065	182065
A	Leg. 3 Required				38046	38046
)	Leg. Dirt Assembly. Propane Gas		-	43761	43761	43761
	Module, Ignition	181	723	181723	181723	181723
	Onfice, Air Flow, FPD Only				181773	181773
	Ontice, Main Burner					
	Natural Gas	181	506-123	181508-123	181508-031	181508-031
	Propane Gas		528-50		181791-50	181791-50
	Orifice, Pilot					
	Natural Gas	. 180	314	180614	180614	180814
	Propane Gas			180824	180624	180824
	Pipe, P V.C. 90° Elbow			181530		
	Pipe, P.V.C. 3' x 48' Length		531-1	181531-1		
	Pipe, P.V.C. 3" x 7" Length			101331-1	181837	181837
	Pipe, P.V.C. 3" x 12" Length				181531	181531
1	Plate, Cover				181938	181938
•					181944	181944
	Plate, Mounting			181615	181557	181557
	Plate, Wall			181557		
	Protector, Personnel			181758	181758	181758
	Rivel	:			181625	181625
	Sealer, Tube High Temp. Siticone Sealant			181564	181564	181564
	Tee, P.V.C 3"				181762	181762
	Tee Assembly, Exhaust, FPSE, PGSE On	nly . 1816	317	181617		• • • •
	Tee Assembly, Condensate			181861	181861	181861
	ECO			181706	181706	181706
	Thermostat			181705	181705	181705
	Tube, Burner:					
	Natural Gas	1814	82-6	181482-7	181482-11	181482-12
	Propane Gas		182-6	181482-7	181792-11	181792-12
	Tube, Inlet		7-33	21067-33	160374-28	160374-28
					23330	23330
	Tube, Pilot			23330	181772	181772-1
	Tube, Rear Air Supply					
	Valve, Drain	2627	3-6	26273-6	42037	42037-1
	Valve, Gas:					
	Natural Gas	1817	21	181721	181950	181950
	Propane Gas	1817	22	181722	182192	182192
	Vaive, Main Gas Shutoff			181737	181737	181737
	Wire, Ground			181736	181736-2	181736-2
	Wire, Harness			181609	181952	181952
				- L. C		
	Sealant must conform to MIL-A-46106A, t	hme 1/FDA:	1 CFR	175.300 Mar	at be able to w	ithstand constant

#### **FPS 75 SERVICE AND OPERATION**

#### Service & Operation Introduction

Most problems will first appear as blower malfunctions; either a blower that does not run or a blower that runs constantly. In these instances, further trouble shooting is required to determine the exact cause. Familiarize yourself with the sequence of operation, study the wiring diagram, and complete the preliminary checks, then if those are OK, go to the section of this workbook that applies to the condition and follow the tests.



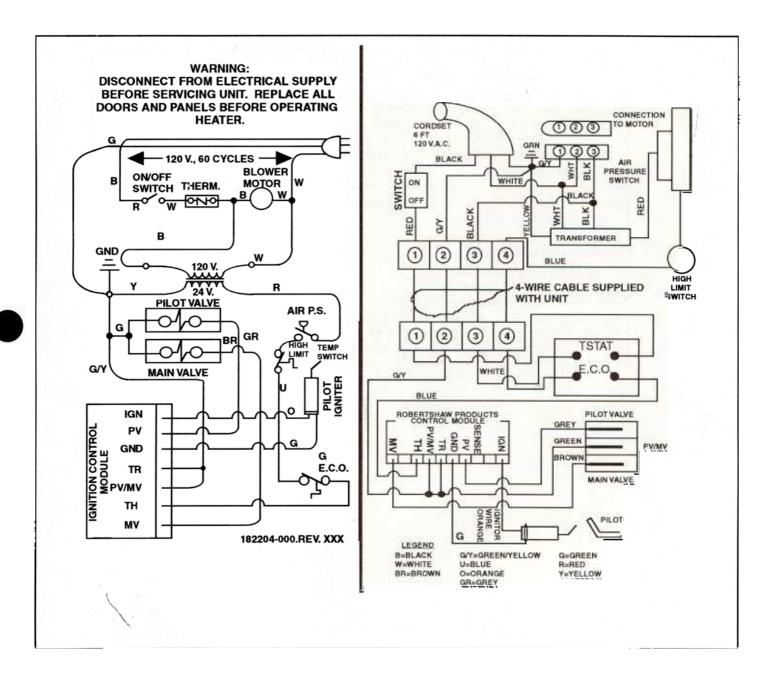
## Sequence of Operation

- 1 Thermostat calls for heat,
- 2 Blower activates,
- 3 Air pressure switch closes,
- 4 Ignition starts,
- 5 Pilot valve opens,
- 6 Ignitor lights pilot and proves pilot,
- 7 Main valve opens,
- 8 Main burner ignites.

#### FPS 75 SERVICE AND OPERATION cont.

Wiring This wiring diagram only applies to model FPS 75 series 230 - 233.

Diagram



## FPS 75 SERVICE AND OPERATION cont.

## Troubleshooting

To troubleshoot the FPS you must understand its sequence of operation. Review that section if necessary. In addition, installation problems can cause the heater to malfunction. Review sections on venting and checking draft. Most problems with the heater will first appear as blower malfunctions.

Subject	Page
Preliminary Checks	Page 71
Blower does not run	Page 72
Blower runs constantly (No call for heat)	Page 76
Blower runs constantly (Calling for heat, no pilot)	Page 79
Blower runs constantly (Calling for heat, pilot is lit, main burner)	Page 89
Pilot Problems	Page 92
Main Burner Problems	Page 93

#### FPS 75 SERVICE AND OPERATION cont

Trouble-	
shooting	cont.

## PRELIMINARY CHECKS

- 1. Gas valve knob is in ON position
- 2. 120 VAC is supplied to heater
- 3. Thermostat is calling for heat
- 4. Blower ON/OFF switch is in the ON position
- 5. Connection between blower motor and blower control box is secure

RESULTS If:	then:
Any of the Preliminary Checks reveal a problem,	repair or replace these items, if necessary, as you would on any standard residential gas water heater.

#### **Cautions**

When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

### Troubleshooting cont.

### **BLOWER DOES NOT RUN**

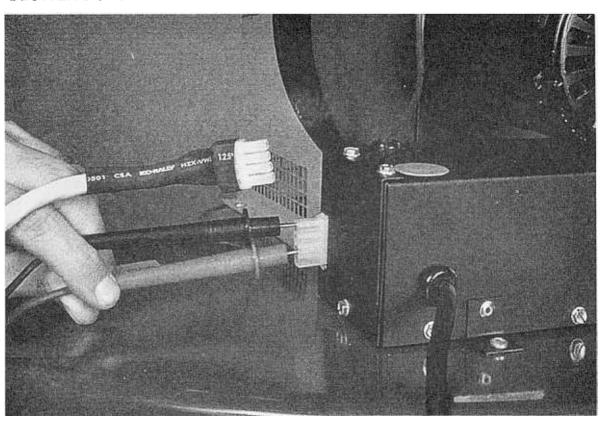
First make the **Preliminary Checks** (see page 71), then perform each of the following tests until cause of the failure is determined:

- 1. Blower Test
- 2. Cable Test
- 3. Thermostat Test

### Cautions

When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

Troubleshooting cont. **BLOWER DOES NOT RUN cont.** 



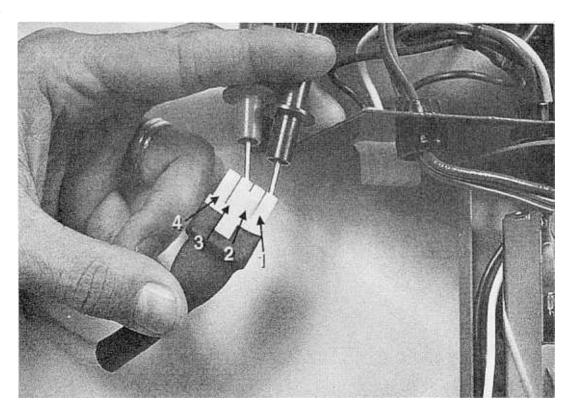
### **BLOWER TEST**

# δ Γ 1 <u>Ε</u>

- Disconnect the 4 wire cable from the blower control box, then
- using a multimeter, test for 120 VAC between pins 1 and 3 on the control box receptacle as shown.

RESULTS If:	then:
the meter does not read 120 VAC,	replace the blower assembly.
the meter does read 120 VAC,	go to Step 2.

Troubleshooting cont. BLOWER DOES NOT RUN cont.



# S T 2 E

# **CABLE TEST**

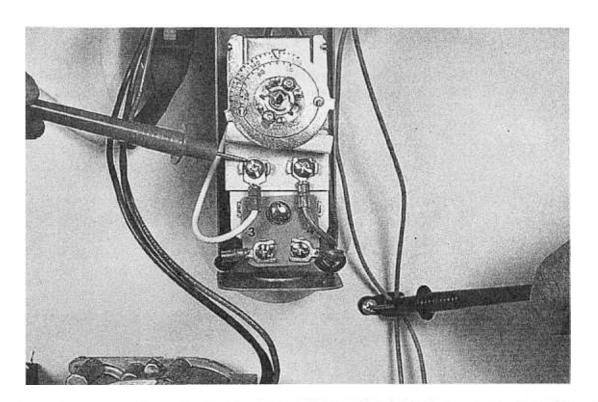
### **SET TEST UP**

- Reconnect cable to blower control box,
- disconnect cable from door receptacle below, then
- using a multimeter, test for 120 VAC between pins 1 and 3 on the cable plug as shown.

RESOLTS		
lf:	then:	
the meter does not read 120 VAC,	replace the cable.	
the meter does reads 120 VAC,	go to step 3.	

Trouble-shooting cont.

BLOWER DOES NOT RUN cont.



# S T 3 E P

# THERMOSTAT TEST

- Reconnect cable to door receptacle,
- Adjust the thermostat to call for heat, then
- using a multimeter, test for 120 VAC at screw on thermostat and ground as shown.

RESULTS If:	then:
the meter does not read 120 VAC,	replace the thermostat.
the meter does read 120 VAC,	go to preliminary checks.

### Troubleshooting cont.

### **BLOWER RUNS CONSTANTLY**

(NO CALL FOR HEAT)

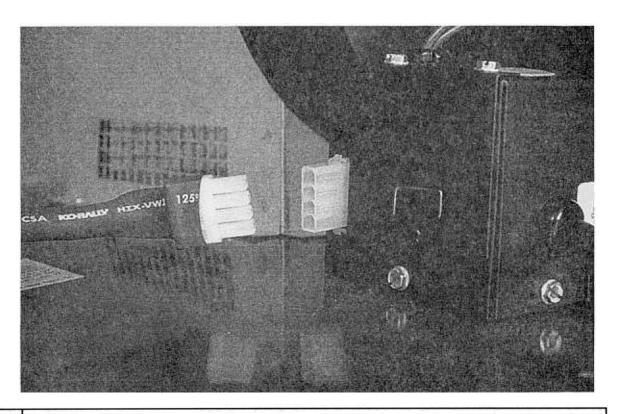
First make the **Preliminary Checks** (see page 71) then perform each of the following tests until cause of the failure is determined:

- 1. Blower Test
- 2. Cable Test

### PRELIMINARY CHECKS EXCEPTIONS

4. Heater should be calling for heat.

Troubleshooting cont. BLOWER RUNS CONSTANTLY (No call for heat) cont.



# **BLOWER TEST**

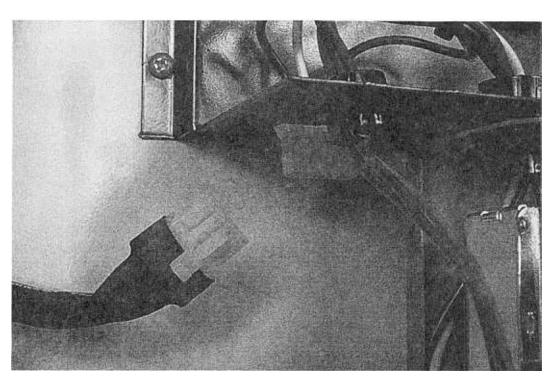
S T 1 E

### **SET UP THE TEST**

- Disconnect the 4 wire cable from the blower control box.

RESULTS	
lf:	then:
the blower continues to run,	replace the blower.
the blower stops,	go to Step 2.

Troubleshooting cont. BLOWER RUNS CONSTANTLY (No call for heat) cont.



# S T 2 E

# **CABLE TEST**

### **SET TEST UP**

- Reconnect cable to blower control box, then
- disconnect cable from receptacle on door below as shown.

RESULTS		
lf:	then:	
the blower continues to run,	replace the cable.	
the blower stops,	see preliminary checks.	

### Troubleshooting cont.

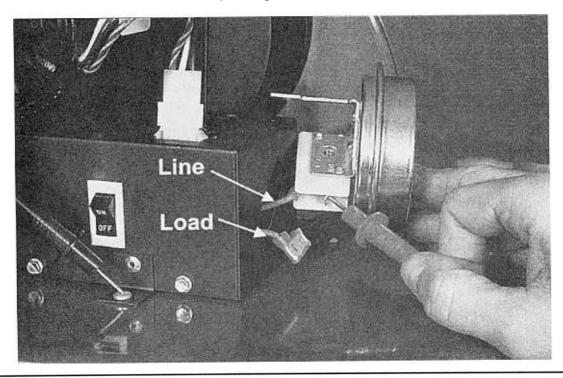
### **BLOWER RUNS CONSTANTLY**

(CALLING FOR HEAT, NO PILOT)

First make the **Preliminary Checks** (see page 71) then perform each of the following tests until cause of the failure is determined:

- 1. Air Pressure Switch Test
- 2. Vent High Limit Test
- 3. Blower Test
- 4. Cable Test
- 5. High Limit Test
- 6. TH Wire Test
- 7. PV MV/PV Test
- 8. Spark Test
- 9. Pilot Solenoid Test

Troubleshooting cont. BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



## AIR PRESSURE SWITCH TEST

S T 1 E

P

- Remove the air pressure switch from control box leaving wires attached,
- remove load wire from air pressure switch,
- using a multimeter, test for 24 VAC between the terminal and ground as shown.
- There are several reasons the air pressure switch may not be making (See pages 10, 11, 12, 17, 18)

RESULTS If:	then:
the meter does not read 24 VAC,	replace the air pressure switch.
the meter does read 24 VAC,	go to Step 2.

Line=24 VAC supply Load=Wire carrying current onto high limit

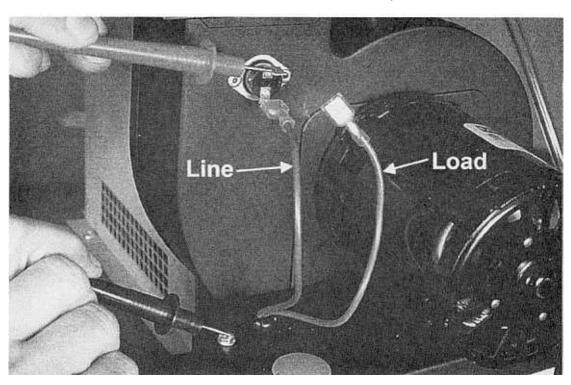
Troubleshooting cont.

S

T

E

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.

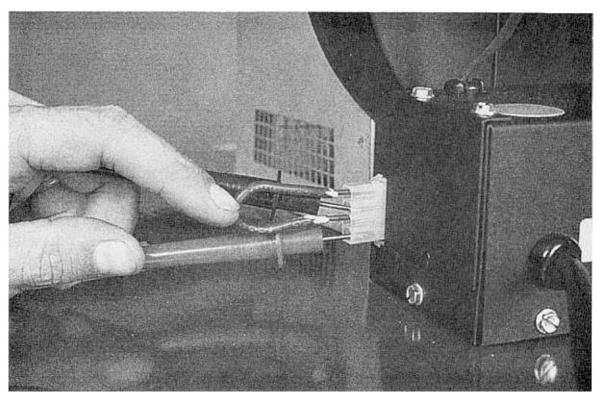


# VENT HIGH LIMIT TEST SET UP THE TEST - Reconnect the air pressure switch, - disconnect the load wire from the vent high limit, then - using a multimeter, test for 24 VAC between wire and ground as shown. - Vent high limit may have shut the heater down due to excessive temperature. See pages 10, 11, 12, 17, 18)

RESULTS If:	then:
the meter does not read 24 VAC,	replace the vent high limit.
the meter does read 24 VAC,	go to Step 3.

Line=24 VAC supply Load=Wire carrying current onto connector

Troubleshooting cont. BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



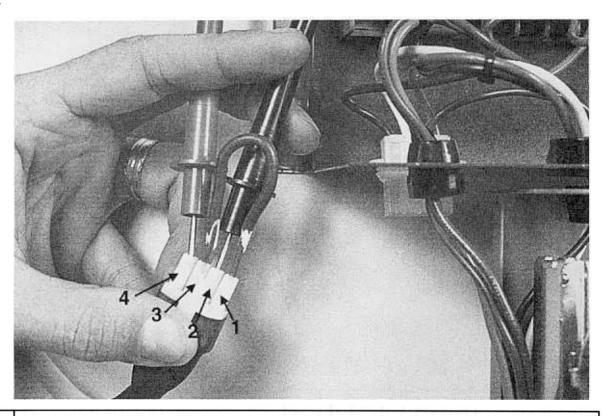
### **BLOWER TEST**

- Reconnect the wire to vent high limit,
- disconnect the 4 wire cable from the blower control box,
- using an insulated jumper wire, jump between pins 1 and 3 (caution 120 VAC) on plug receptacle, then
- using a multimeter, test for 24 VAC between pins 2 and 4 as shown.

RESULTS If:	then:
the meter does not read 24 VAC,	replace the blower.
the meter does read 24 VAC,	go to Step 4.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



# **CABLE TEST**

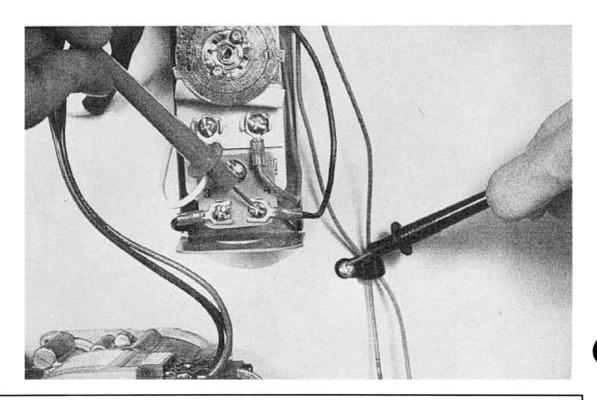
S T 4

080

- Reconnect the 4 wire cable to the blower control box,
- disconnect the cable from receptacle on door below,
- using an insulated jumper wire, jump between pins 1 and 3 (caution 120 VAC) on cable plug , then
- using a multimeter, test for 24 VAC between pins 2 and 4 as shown.

RESULTS If:	then:
the meter does not read 24 VAC,	replace the cable.
the meter does read 24 VAC,	go to Step 5.

Troubleshooting cont. BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



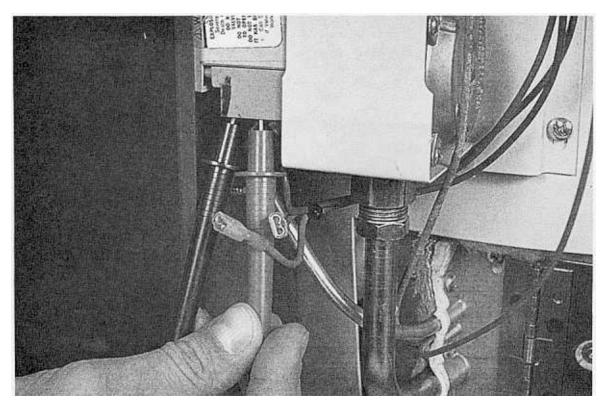
# S T 5 E

# HIGH LIMIT TEST

- Reconnect the cable to receptacle on the door,
- remove covers from door and thermostat,
- inspect wire between connector and high limit for lack of continuity or loose connections, correct either of these conditions if necessary,
- remove one of the wires from the high limit, then
- using a multimeter, test for 24 VAC at screw on high limit and ground as shown.

RESULTS If:	then:
the meter does not read 24 VAC,	replace high limit.
the meter does read 24 VAC,	go to Step 6.

Troubleshooting cont. BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



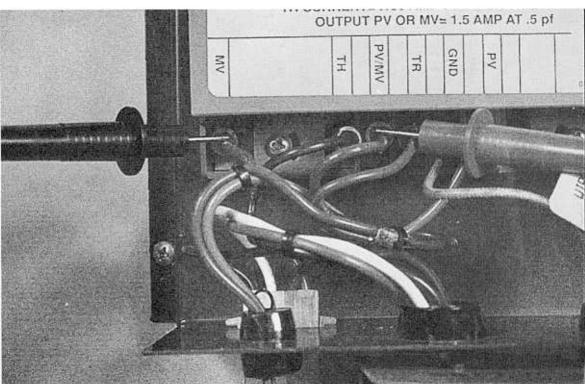
# S T 6 E

# TH WIRE TEST

- Reconnect the wire to high limit,
- inspect wire between high limit and I.I.D. for lack of continuity or loose connections, correct either of these conditions if necessary, then
- using a multimeter, test for 24 VAC at TH wire on the I.I.D. and ground as shown.

RESULTS		
lf:	then:	
the meter does not read 120 VAC,	replace wire.	
the meter does read 120 VAC,	go to Step 7.	

Troubleshooting cont. BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



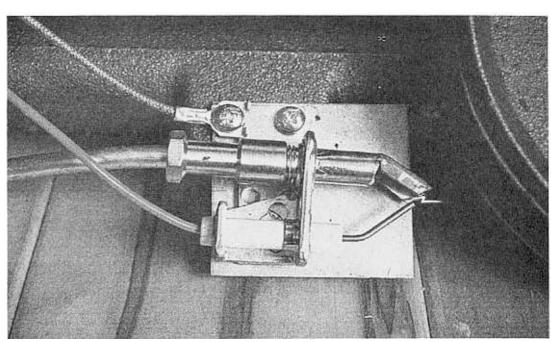
# PV - PV/MV TEST

# S T 7 E

- Using a multimeter, test for 24 VAC between PV (pilot valve) and PV/MV on I.I.D. as shown.
- Sparking should stop when pilot is lit. (If sparking does not stop see page 92)

RESULTS	
If:	then:
the meter does not read 24 VAC,	replace the I.I.D.
the meter does read 24 VAC,	go to Step 8.

Troubleshooting cont. BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



### **SPARK TEST**

### S T

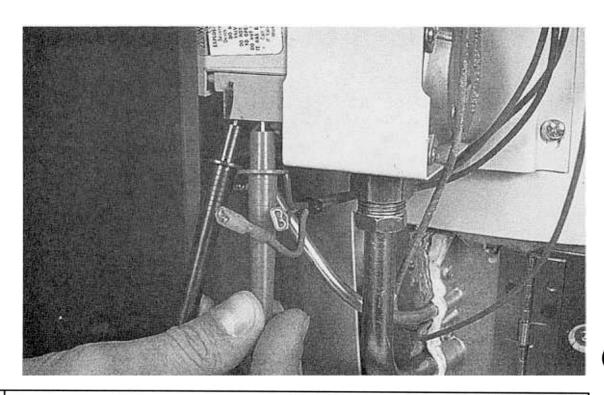
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**D** 

- Reset the ON/OFF switch, then
- visually check the spark at the pilot assembly.
- Sparking should stop when pilot is lit. (If not see page 92)

RESULTS If:	then:
the electrode is not sparking,	<ul> <li>check 7/64" spark gap between pilot hood and electrode.</li> <li>check spark cable continuity.</li> <li>check ground cable continuity at I.I.D.</li> </ul>
the electrode is sparking,	go to Step 9.

Troubleshooting cont. BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



# PILOT VALVE TEST

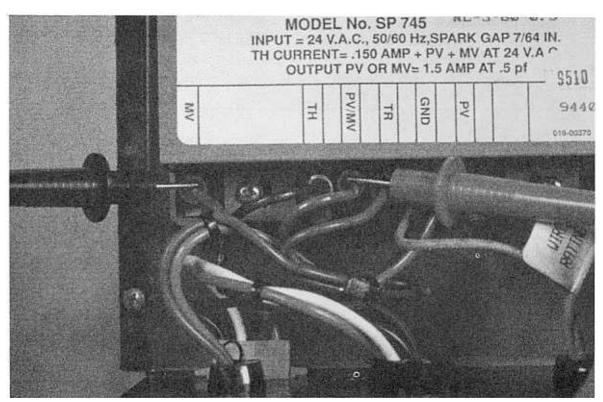
S T 9 E P

- inspect wire between I.I.D. and pilot valve for lack of continuity or loose connections, correct either of these conditions if necessary, then
- disconnect the wire from the pilot valve, then
- using a multimeter, test for continuity at pilot valve as shown.

RESULTS If:	then:
the meter does not read continuity,	replace the valve.
the meter does read continuity,	check the gas supply.

Trouble- shooting cont.	BLOWER RUNS CONSTANTLY (CALLING FOR HEAT, PILOT IS LIT, NO MAIN BURNER)
	First make the <b>Preliminary Checks</b> (see page71) then perform each of the following tests until cause of the failure is determined:  1. MV - MV/PV Test  2. Main Valve Test

Trouble- BLOWER RUNS CONSTANTLY (Calling for heat, pilot is lit, no main burner) shooting cont.



# S T 1 E

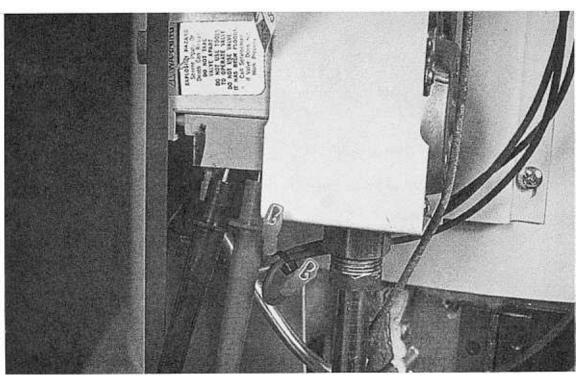
### **MV - PV/MV TEST**

### **SET UP THE TEST**

- Using a multimeter, test for 24 VAC between MV and MV/PV on I.I.D. as shown.

RESULTS If:	then:
the meter does not read 24 VAC,	replace the I.I.D.
the meter does read 24 VAC,	go to Step 2.

Troubleshooting cont. BLOWER RUNS CONSTANTLY (Calling for heat, pilot is lit, no main burner) cont.



# S T 2 E

# **MAIN VALVE TEST**

- inspect wire between I.I.D. and main valve for lack of continuity or loose connections, correct either of these conditions if necessary, then
- using a multimeter, test for continuity on main valve as shown.

RESULTS If:	then:
the meter does not read continuity,	replace the main valve.
the meter does read continuity,	check gas supply.

### Troubleshooting cont.

### **PILOT PROBLEMS**

The following are possible causes of pilot problems:

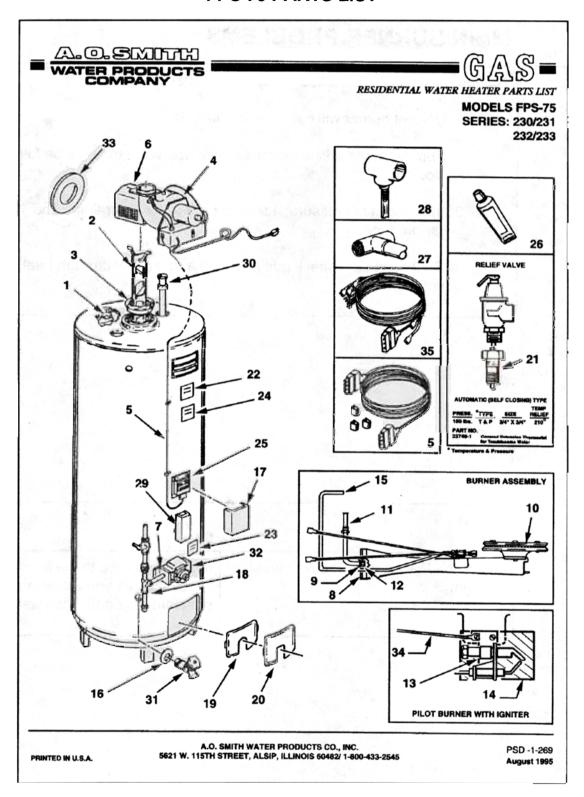
- 1. An open E.C.O. (high limit) will not allow the heater to relight. (See page 84).
- 2. Incorrect pilot gas pressure: it should be 3.5" for natural gas and 10" for propane.
- 3. Excessive equivelant foot length on vents can cause pilot outages.
- 4. Incorrect pilot position; the pilot should engulf the tip of the flame sensor 3\8" to 1\2".
- 5. A leak in pilot tube will cause candling.

then:
repair or replace these items, if necessary, as you would on any standard residential gas water heater.

Trouble- shooting cont.	MAIN BURNER PROBLEMS	
	The following are possible causes of main burner problems:	
	Unlevel burner will cause yellow flames.	
	<ol><li>Burning at the orifice indicates main gas valve may not be fully closing.</li></ol>	
	<ol> <li>Incorrect gas pressure; it should be 3.5" for natural gas and 10" for propane.</li> </ol>	
	Soot build-up. Check gas pressure and air flow through heater and venting.	

RESULTS If:	then:
Any of the Preliminary Checks reveal a problem,	repair or replace these items, if necessary, as you would on any standard residential gas water heater.

### **FPS 75 PARTS LIST**



### FPS-75 SERIES 230/231 THRU 232/233

ltem	Description	Part Number
1 /	Anode	180618-42
	Baffle	
2	Baffle, Flue	182193
3	Flue Restrictor	35405
	Blower	
4	Blower Assembly	182225
5	Blower Wiring Hamess	3 181728-1
6	Fan Housing	
7 [	Bracket, Gas Valve	182179
	Burner	
8	Air Shutter	35376
9	Lock Nut	29001
10	Main Burner	41157-4
11	Main Burner Tube, Nat	t 39114-4
11	Main Burner Tube, Pro	p 181784-2
12	Orifice, Main Burner, N	lat 29366-21
12	Orifice, Main Burner, P	rop 181778-39
13	Pilot Assembly, Nat	181954-2
13	Pilot Assembly, Prop	181954-3
14	Pilot Mounting Plate	192625
15	Pilot Tube	23330
16 (	Collar, Pipe	20172-6
17 (	Cover, Control Panel	182181
18	Dirt Leg (Supp. on Prop	43761
1	Door	
19	Inner	39923
20	Outer	
21	Extender, T&P Valve	43231-1
- 1	Label	
22	Flammable Warning	181139
23	Lighting & Operating .	
24	Scald Warning	
	Module, Ignition	
	Silicone, High Temp	
	Tee, 3" P.V.C	
	Tee, Condensate	
	Thermostat w/E.C.O	
	Tube, Inlet	
	Valve, Drain Valve	26273-7
32	Gas, Nat	182238
32	Gas, Prop	
	Wall Plate	
	Wire, Ground	
	Wire, Harness	

### **PART INFORMATION**

CONTROL	MODELS	SPECIFICATION
Fan	FPS40 - 50 FPSE & FPD40 - 50 FPS75	Draws .75 amp, Turns at 3325 RPM Draws .75 amp, Turns at 3325 RPM Draws 1.8 amp, Turns at 3000 RPM
Air Pressure Switch	FPS40 - 50 FPSE & FPD40 - 50 FPS75	Closes at .3 PSI Closes at .3 PSI Unavailable at this time
Thermostat	FPS40 - 50 FPSE & FPD40 - 50 FPS75	Temperature range no lower limit to 160° Temperature range 110° - 150° Temperature range 120° - 160°
High Limit	FPS40 - 50 FPSE & FPD40 - 50 FPS75	Opens at 195° Opens at 160° Opens at 195°
Gas Valve	FPS40 - 50 FPSE & FPD40 - 50 FPS75	operating pressure - natl. 3.5" w.c., l.p. 10" w.c. operating pressure - natl. 3.5" w.c., l.p. 10" w.c. operating pressure - natl. 3.5" w.c., l.p. 10" w.c.
Pilot	FPS40 - 50 FPSE & FPD40 - 50 FPS75	Standing pilot I.I.D. Draws 1.63 amps I.I.D. Draws 1.63 amps
Gas Pressure Switch	FPS40 - 50	Closes at 2.5" w.c. for natural Closes at 6.5" w.c. for propane
Vent High Limit	FPS75	Opens at 190° closes at 150°
Vent Material	All models	PVC (Class 160, ASTM D-2241; Schedule 40, ASTM D-1785, or Cellular Core Schedule 40 DWV, ASTM F-891), Schedule 40 CPVC (ASTM F-441), or ABS (ASTM D-2661) pipe. The fittings other than the TERMINATION TEE, should be equivalent to PVC_DWV fittings meeting ASTM D-2665 (Use CPVC fittings, ASTM F-438 for CPVC pipe and ABS fittings, ASTM D-2661/3311 for ABS pipe. If CPVC or ABS pipe and fittings are used, then the proper cement must be used for all joints, including joining the pipe to the Termination Tee (PVC Material).

### **SERVICE CHECKLIST**

### VI. PROPER SEQUENCE OF OPERATION

During standby is blower off? On a call for heat does gas valve open? Does gas pressure switch close? Does the blower come on? If so, does the air pressure make? Does main burner ignite? On a call for heat does gas valve open? Does main burner ignite?  A. FPSE40 - 50  During standby is blower off? On a call for heat does gas valve open? Does the blower come on? If so, does the air pressure make?  A. FPD40 - 50  During standby is blower off? On a call for heat does gas valve open? Does the blower come on? If so, does the air pressure make?  A. FPD40 - 50  During standby is blower off? On a call for heat does gas valve open? Obes the solenoid open? Does the solenoid open? Does the solenoid open? On boes the air pressure make?  A. FPD40 - 50  During standby is blower off? On a call for heat does gas valve open? Does the solenoid open? Does the blower come on? If so, does the air pressure make? Does the thermostat satisfy?  Comments:  A. FPS75  During standby is blower off? On a call for heat does gas valve open? Does the blower come on? If so, does the air pressure make? Does the blower come on? If so, does the air pressure make? Does the blower come on? If so, does the air pressure make? Does the solenoid open? One call for heat foles? Does main burner ignite? Does the solenoid open? Uses no Does the solenoid open? Does the solenoid open? Uses no Does the solenoid open?	A. FPS40 - 50		
Does gas pressure switch close?  Does the blower come on?  If so, does the air pressure make?  Does main burner ignite?  Comments:  A. FPSE40 - 50  During standby is blower off?  On a call for heat does gas valve open?  Does the air pressure make?  Does the blower come on?  If so, does the air pressure make?  Does the blower come on?  Comments:  A. FPDE40 - 50  During standby is blower off?  On a call for heat does gas valve open?  Does the blower come on?  If so, does the air pressure make?  Does the thermostat satisfy?  Does the thermostat satisfy?  Does main burner ignite?  A. FPDE40 - 50  During standby is blower off?  On a call for heat does gas valve open?  Does gas pressure switch close?  Does the blower come on?  If so, does the air pressure make?  Does the blower come on?  If so, does the air pressure make?  Does the blower come on?  On a call for heat does gas valve open?  Does the blower come on?  If so, does the air pressure make?  Does the blower come on?  On a call for heat does gas valve open?  Does main burner ignite?  Does main burner ignite?  Does main burner ignite?  Does main burner ignite?  On a call for heat does gas valve open?  Does main burner ignite?  Does the blower come on?  If so, does the air pressure make?  Does the blower come on?  If so, does the air pressure make?  Does the blower come on?  If so, does the air pressure make?  Does the blower come on?  On a call for heat does gas valve open?  Does gas pressure switch close?  Does the blower come on?  On a call for beat does gas valve open?  Does the blower come on?  On a call for beat does gas valve open?  Does the blower come on?  On a call for beat does gas valve open?  Does the blower come on?  On a call for beat does gas valve open?  Does the blower come on?  On a call for beat does gas valve open?  Does the blower come on?  On a call for beat does gas valve open?  Does the blower come on?  On a call for beat does gas valve open?  Does the blower come on?  On a call for beat does gas valve open?  On a call for beat does gas	During standby is blower off?	yes	no
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Does the thermostat satisfy? yes no		-	
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### SERVICE CHECKLIST cont.

### VII. SAFETY

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Λ	Cac

Does pilot flame prove before main burner ignites?	yes	no
Does damper blade fully open before ignition sequence occurs?	yes	no
Is burner cover plate in place?	yes	no
Is burner floor shield in place?	yes	no
Does IID lockout occur after 30 sec. trial for ignition? (Propage models only)	ves	no

### B. Water Temperature

Is the thermostat adjusted to the lowest acceptable temperature?	yes	no
Does the installation have a mixing valve?	yes	no
If so, is it operational?	yes	no
What is the outlet temperature of the mixing valve?		

# NOTE: (Consumer Product Safety Commission advises that water temperature above 130 degrees F. may cause scalding.)

Is a properly rated temperature and pressure relief valve installed? yes no

### C. Electrical

Is the 120 VAC electrical power supply properly wired?	yes	no
Are all the control covers in place?	yes	no
Is the 120 VAC electrical power supply properly fused?	yes	no

### D. Flammables

Are flammable materials located in the area of the water heater?	yes	no
Are flammable vapors located in the area of the water heater?	ves	no

### Comments:

### **QUESTIONS AND ANSWERS**

### **FPS MODELS**

- Q. What is the CFM of the blower?
- A. Maximum of 60 CFM.
- Q Will the blower move more air through the unit than conventional venting and thereby cause less heat to be transferred into the water?
- A. No. The unit has been tested to the DOE test methods for recovery efficiency using the minimum and maximum amount of vent piping with the resulting GPH rates as shown on the spec sheet. The baffle and air intakes of the heater still regulate chamber air flow.
- Q. Can this unit be vented to a chimney?
- A. No. The unit may have condensing flue gases which would attack mortar or standard vent piping.
- Q Can I vent the FPS unit vertically?
- A. The Series 216 & 217 are sidewall venting only.

  The Series 220 and higher can be vented either vertically or horizontally.
- Q Will a snow/riser kit be available?
- A. A snow riser kit can be constructed in the field in parts of the country where applicable. The venting should be terminated a minimum of 12 inches above expected snowfall accumulations.

Avoid installations where snow drifting or prevailing wind conditions will interfere with the venting of the heater. Installation of a condensate tee is necessary to prevent condensation from reaching the blower housing.

### QUESTIONS AND ANSWERS cont.

- Q Is there a maximum distance that the vent cap can terminate from the exterior wall?
- A. No, as long as the overall equivalent length is not exceeded. We would advise that the exterior piping have a slight negative slope and be properly supported and insulated (The colder the vent piping, the more condensation will be experienced).
- Q. Can this unit terminate in a window well?
- A. No. Clearances to an air inlet opening must be observed.
- Q. What is the maximum temperature at which of the sealant will function properly?
- A. 400 deg. F
- Q May I paint the vent piping?
- A. Yes. Use a latex paint if it will adhere to the smooth surface. Do not use oil based paint, they contain solvents which may attack the PVC.
- Q May I use an FPS to replace a Sidewinder?
- A. Yes, but the entire FFS unit must be used. Note that the FPV/KPV units use a larger joint penetration hole than is necessary for the FPS. Close the gap by using insulation and a centering plate to center the vent pipe and prevent air drafts into the house.
- Q. If the vent is blocked, will the blower motor continue to run?
- A. Yes, but the air pressure switch will open and interrupt power to the gas solenoid valve shutting off main burner gas flow.
- Q. Will increasing the vent pipe size allow a longer equivalent feet run?
- A. No, the 3 inch vent is the only sized venting approved.

### ADDITIONAL INFORMATION

If the inlet air damper does not open to provide dilution air, the PVC vent will sag due to excessive temperature.

Propane units do not have a bypass in the gas solenoid valve. This may result in occasional cycling stand by between calls for heat. If you experience more than two stand by cycles per hour, consider replacing the main gas control valve.

If hard wiring is required by local codes, use the knockout provided on the blower control box.

For Further Info.	Contact: A. O. Smith Technical Information Center Rochelle Park, Suite 200	
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